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VOLUME 15 NOVEMBER, 1941 NUMBER 6

EOCENE SMALLER FORAMINIFERA FROM THE SALT MOUNTAIN LIMESTONE OF ALABAMA[1]

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ABSTRACT—The smaller Foraminifera of the Salt Mountain limestone are described and figured. Two new genera, *Eggerina* and *Alabamina*, are proposed. Fifteen species and one variety are described as new. The Salt Mountain limestone is similar lithologically and faunally to the upper Midway limestone quarried near Rutledge, Crenshaw County, Alabama, and exposed on the Chattahoochee River at Ft. Gaines, Georgia. Foraminifera, however, indicate that the Salt Mountain limestone, at least the upper part, is younger than Midway and probably is early Wilcox in age.

THE Salt Mountain limestone was first described by Smith and Johnson (1887). They called it the "Coral limestone." Langdon (1891) was the first to use the term Salt Mountain limestone. The true stratigraphic position of the formation was not determined until 1932 (Crider, and others, 1932) when it was ascertained to belong to the Wilcox group (lower Eocene).

The Salt Mountain limestone is exposed only in the vicinity of the type locality, Salt Mountain, 6 miles south of Jackson in Clarke County, Alabama. It was brought to the surface on the upthrown side of the Jackson fault. The outcrop covers a north-south distance of 3 miles along the fault. It is approximately 90 feet in thickness at the type locality and consists of very hard, dense limestone, and soft limestone occurring in pockets or beds of irregular thickness and lateral extent. The limestone is white or cream-colored. Several analyses indicate that the composition of the limestone averages 95 per cent calcium carbonate. An analysis of a typical sample from the top of Salt Mountain is given below.

ANALYSIS OF SALT MOUNTAIN LIMESTONE. AIR DRIED SAMPLE[2]

Moisture	0.30%
Silica	1.82
Iron and aluminum oxides	1.40
Calcium carbonate	95.76
Magnesium carbonate	0.70

Limestone brought up in cores from a deep well in Baldwin County, Alabama, is assigned to this formation (Eby and Nicar, 1936). The bed is 90 feet thick and occurs 1040 feet beneath the top of the Wilcox group according to the well log. A deep well in northern Florida penetrated 196 feet of Salt Mountain limestone (Cole, 1938). It is about 683 feet beneath the top of the Wilcox group.

The formation contains two Discocyclinidae (Vaughan, 1936), two described species of corals (Vaughan, 1900), fragments of echinoderms, abundant remains of Bryozoa, small brachiopods belonging to seven genera (Toulmin, 1940-a), and more than 20 species of ostracodes.

[1] This paper is a portion of a dissertation submitted to the Department of Geology of Princeton University in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

[2] R. S. Hodges, analyst.

Series	Group	Formation	Columnar Section	Thickness in Feet	Character
Eocene	Jackson	Moodys marl and Yazoo clay		80-125	Gray marl, calcareous sand and green calcareous clay west of Tombigbee River.
		Ocala limestone		40-60	Sandy marl and soft chalky limestone east of Tombigbee River.
	?	Gosport sand		15-35	Fossiliferous greensands and nonmarine clays. Absent in east Alabama.
		Disconformity			
	Claiborne	Lisbon formation		70-170	Fossiliferous calcareous sand, blue clay, and blue sandy marl.
		Tallahatta formation		140-300	Green to white claystone, sandstone, and sand. The hard strata are better developed in west Alabama
		Disconformity			
	Wilcox	Hatchetigbee formation		175-200	Gray hackly sandy clays and sands. Thins to 22 feet on the Chattahoochee River.
		Bashi formation		50-85	Thin lignite seams, cross-bedded sands, and sandy clays. Fossiliferous greensand marl at top forming pillow-shaped boulders.
		Tuscahoma formation		140-170	Laminated sandy clays containing two fossiliferous marl beds.
		Nanafalia formation		170±	Fossiliferous greensand marl overlain by gray clays which are indurated in central Alabama.
		and			
		Salt Mountain limestone		90	White limestone facies south of the Nanafalia outcrop. Exposed only at Salt Mountain.
		Ackerman formation		0-80	Lignite overlain by laminated dark clays and sands and white cross-bedded sands. Absent in east Alabama.
		Disconformity			
Paleocene	Midway	Naheola formation		150	Fossiliferous greensand marl overlain by gray cross-bedded sands and thin beds of gray sandy clay. Absent along Chattahoochee River.
		Sucarnoochee clay		0-200	Brown to black joint clay. Absent in east Alabama.
		Clayton formation		50-200	Red to white micaceous sand, white calcareous sand, yellow to white limestone, and sandy limestone.
		Disconformity			
Upper Cretaceous		Selma chalk and Ripley formation			White chalk in west Alabama. Marine sands and clays in east Alabama.

FIG. 1.—Columnar section of the Paleocene and Eocene formations of Alabama.

The presence of reef corals in the Salt Mountain limestone indicates a warm, shallow, clear-water environment. Other elements of the fauna also indicate this type of environment. All modern species of the brachiopod genus *Thecidellina*, for example, have a tropical distribution, and several are found in association with reef corals.

The stratigraphy and structure of the Salt Mountain area and the faunal groups represented by fossils in the limestone are fully discussed in Alabama Geol. Survey Bull. 46 (Toulmin, 1940-b).

The foraminiferal fauna of the Salt Mountain limestone consists of 97 species and varieties of smaller Foraminifera and two larger Foraminifera, *Discocyclina blanpiedi* Vaughan and *Pseudophragmina* (*Athecocyclina*) *cookei* (Vaughan). The fauna is closely related to an upper Wilcox fauna described by Cushman and Ponton (1932) from Ozark, Alabama. The Ozark fauna consists of 48 species. Nineteen of the Salt Mountain species are present also in the upper Wilcox greensand marl at Ozark. Eight of these species seem to be confined to formations of the Wilcox group or beds of equivalent age. Cushman and Garrett (1939) recently described and figured 40 species from the Bashi formation (upper Wilcox) of Woods Bluff, Alabama. Ten of these species occur in the Salt Mountain limestone.

The Salt Mountain fauna has a large number of species in common with the fauna described from the Midway group of Texas by Plummer (1927). The fauna of the Midway group, described by Plummer, comprises 104 species and varieties. The species recorded from the Kincaid formation (lower Midway) number 42; those from the Wills Point formation (upper Midway) number 90. Of the 97 smaller Foraminifera of the Salt Mountain limestone, 11 are present in the lower Midway of Texas, and eight of these species are present also in the upper Midway. Eighteen of the Salt Mountain limestone species are present in the upper Midway of Texas. A fauna of Midway age in Alabama has recently been published (Cushman, 1940). It is closely similar to that of the Texas Midway and contains 14 species in common with the Salt Mountain limestone.

Several species are common in the Texas and Alabama Midway and in the Salt Mountain limestone, but the range of these does not extend to the upper Wilcox, or, at least, these species have not yet been recorded from any of the upper Wilcox formations. Among the more important of these are *Textularia plummerae* Lalicker, *Robulus midwayensis* (Plummer), *Lenticulina degolyeri* (Plummer), *Dentalina gardnerae* (Plummer), *Dentalina* cf. *D. pomuligera* Stache, *Frondicularia frankei* Cushman, *Chrysalogonium granti* (Plummer), *Pullenia quinqueloba* (Reuss), *Globigerina compressa* Plummer, and *Anomalina acuta* Plummer. Three of these species, *R. midwayensis*, *Dentalina* cf. *D. pomuligera*, and *A. acuta*, have been observed in samples collected from outcrops of the Nanafalia formation of lower Wilcox age.

Jennings (1936) described 23 species of Foraminifera from the Hornerstown formation of New Jersey. The Salt Mountain limestone his six species in common with the Hornerstown. A sample of Vincentown limesand collected from the north bank of Rancocas Creek a quarter of a mile northwest of Vincentown, New Jersey, was observed to have many species in common witl the Salt Mountain limestone. Over 20 per cent of the Salt Mountain species are present in the Vincentown.

It is noteworthy that the Salt Mountain limestone contains very few species in common with the formations of lower Eocene age in the Tampico region of Mexico according to published lists of species. Muir (1936) listed numerous species from the Tanlajás formation which is correlated with the Wills Point formation of Texas. Nuttall (1930) listed and described a total of 54 species and varieties of Foraminifera from the Aragón. The Salt Mountain limestone contains only six species in common with the Tanlajás and four species in common with the Aragón. All are widely distributed species with long ranges except *Globigerina compressa* Plummer which is present in the Tanlajás.

Israelsky (1939) has figured 41 species of Foraminifera from the Eocene of Marysville Buttes, California, many of which are strikingly similar to, and 10 probably identical with, Salt Mountain species.

Glaessner (1937) listed and described 73 species of Foraminifera from the Tertiary of

the northwest Caucasus. Nine of these species are present in the Salt Mountain limestone.

A marl bed about one foot thick occurs just above the Salt Mountain limestone at Richmond Branch (Station 3) and contains a few species that have not been observed in the limestone, including *Quinqueloculina* sp., *Pyrgo* sp., *Robulus alato-limbatus* (Gümbel), *Astacolus* cf. *A. pseudomarcki* (Cushman), *Pseudoglandulina* sp., *Pseudopolymorphina wilcoxensis* Cushman and Ponton, *Loxostoma wilcoxense* Cushman and Ponton, *Nodosarella attenuata* (Plummer), *Parrella expansa*, n. sp., and *Discorbis allomorphinoides* (Reuss). Three of these species have been recorded from the Midway of Texas by Plummer and two from the upper Wilcox of Alabama by Cushman and Ponton.

Limestone exposed in the vicinity of Rutledge, Crenshaw County, Alabama, closely resembles the Salt Mountain limestone and contains a large number of the same distinctive species, including several Foraminifera, Bryozoa, Brachiopoda, and Ostracoda. It also contains *Cidaris splendens* (Morton). Upper Midway limestone containing the same fauna is exposed on the Chattahoochee River at Ft. Gaines, Georgia, where it is overlain disconformably by the lower Wilcox Nanafalia formation. No disconformity was evident in the section half a mile north of Salt Mountain, from Station 1 up to Station 3, where the Foraminifera described in this paper were obtained. The presence of a large number of Foraminifera that are not known below the Wilcox, and especially the presence of several Wilcox species in place of the closely related Midway forms, indicates that the Salt Mountain limestone, at least the upper part, is younger than Midway and probably is early Wilcox in age.

The writer is greatly indebted to Dr. Joseph A. Cushman for generously allowing him to work in his laboratory in Sharon, Massachusetts, and to use his card catalogue, collections, and library. Mrs. Helen Jeanne Plummer of Austin, Texas, has been especially helpful during the course of this investigation. She has given invaluable advice and helpful criticism, and has very generously furnished specimens from her collection for study. Grateful acknowledgment is made to Princeton University and to the Geological Survey of Alabama for financial assistance in the field. A contribution to help cover the cost of illustrations was received from the Van Ingen Fund administered by Princeton University. Some of the specimens are illustrated by camera lucida drawings, line drawings, and photographs made by the writer. The majority of the illustrations are drawings made by Miss Miriam Pollak of Columbia University.

Holotypes and paratypes of new species are in the Princeton University collection. Other paratypes and duplicate specimens are in the collections of Mrs. Helen Jeanne Plummer, the Cushman Laboratory, and the Alabama Museum of Natural History.

LIST OF STATIONS

The following collecting stations are in the Salt Mountain limestone with the exception of Station 3. They are all in Clarke County, Alabama.

Station 1.—Limestone sink, generally referred to as a "spring," half a mile north of Salt Mountain, in the NW ¼ NW ¼ sec. 34, T. 6 N., R. 2 E. About 10 feet of typical Salt Mountain limestone is exposed. The softer limestone is rich in Foraminifera and ostracodes. This is the type locality for *Discocyclina blanpiedi* Vaughan.

Station 2.—Exposure of the uppermost portion of the Salt Mountain limestone in the bed of Richmond Branch, 400 feet southeast of the "spring" (Station 1), in the NW ¼ NW ¼ sec. 34, T. 6 N., R. 2 E. The soft limestone at this locality is extremely rich in Foraminifera, ostracodes, and Bryozoa, and the fauna is much better preserved than at any other locality in the Salt Mountain limestone. This is the type locality for *Eggerina cylindrica*, n. sp., *Robulus magnificus*, n. sp., *Robulus knighti*, n. sp., *Marginulinopsis wilcoxensis*, n. sp., *Vaginulinopsis exquisita*, n. sp., *Palmula mcglameryae*, n. sp., *Polymorphinella subcompressa*, n. sp., *Polymorphinella elongata*, n. sp., *Coleites laevigatus*, n. sp., *Eponides dorfi*, n. sp., *Cibicides howelli*, n. sp., *Cibicides blanpiedi*, n. sp., *Globorotalia wilcoxensis* Cushman and Ponton var. *acuta*, n. var., and *Argyrotheca saltmountainensis* Toulmin.

Station 3.—Wilcox marl bed, about 3 to 5 feet stratigraphically above the Salt Moun-

tain limestone, in Richmond Branch, 610 feet N. 45° E. of the "spring," in the NW ¼ NW ¼ sec. 34, T. 6 N., R. 2 E. *Discocyclina blanpiedi* Vaughan is very conspicuous in this marl. The microfauna is excellently preserved. This is the type locality for *Eggerella plummerae*, n. sp. The hypotypes of *Bulimina ovata* d'Orbigny, *Pseudoglandulina manifesta?* (Reuss), *Pseudoglandulina comata* (Batsch), *Robulus midwayensis* (Plummer), *Dentalina vertebralis* (Batsch), and *Siphonina wilcoxensis* Cushman that are illustrated were selected from this locality.

Station 4.—Salt Mountain, in the SW ¼ SW ¼ sec. 34, T. 6 N., R. 2 E. Collections were made at several places on the west side of Salt Mountain where pockets of soft limestone occur. This is the type locality for *Thecidellina cooperi* Toulmin. The holotype came from a horizon 30 feet below the top of Salt Mountain. Probably this is also the type locality for *Pseudophragmina* (*Athecocyclina*) *cookei* (Vaughan), *Actinacis alabamensis* (Vaughan), and *Stylophora ponderosa* Vaughan. Collections were made at the following elevations:

a.—106 feet below the top of Salt Mountain
b.—101–104 feet below top
c.—90 feet below top
d.—65–68 feet below top
e.—60 feet below top
f.—51 feet below top
g.—48 feet below top
h.—40 feet below top
i.—30 feet below top
j.—26 feet below top
k.—20 feet below top
l.—15 feet below top

Station 5.—Outcrop of Salt Mountain limestone on the Jackson-Rockville road, a few hundred feet south of Salt Mountain in the SW ¼ SW ¼ sec. 34 ,T. 6 N., R. 2 E. This is the uppermost portion of the limesone. Fossils are not abundant.

Station 6.—Exposure of limestone in road cut at the foot of Salt Mountain, 400 feet southeast of small bridge at edge of Salt Mountain. The limestone contains a well-preserved microfauna and numerous specimens of *Discocyclina*.

Station 7.—Salt Mountain limestone exposure at the top of a small hill in the SE ¼ NE ¼ sec. 4, T. 5 N., R. 2 E., 300 feet south of an old logging trail. The fauna is large, but the specimens are badly weathered. Brachiopods are common.

Station 8.—Exposure of limestone on top of hill, 400 feet north of an old logging trail in the SW ¼ NW ¼ sec. 3, T. 5 N., R 2 E.

Station 9.—Exposure of limestone at the head of the first gully, 300 feet south of the creek, in the NE ¼ NE ¼ sec. 9, T. 5 N., R. 2 E.

Station 10.—Exposure of Salt Mountain limestone in a gully south of Section 16 Branch near the foot of a high hill, in the NW ¼ NE ¼ sec. 16, T. 5 N., R. 2 E.

SYSTEMATIC DESCRIPTIONS

Family TEXTULARIIDAE

Genus SPIROPLECTAMMINA Cushman, 1927

SPIROPLECTAMMINA WILCOXENSIS Cushman and Ponton

Plate 78, figure 1

Spiroplectammina wilcoxensis CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 51, pl. 7, figs. 1a, b. (Ozark, Alabama). CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15,¶p. 78, pl. 13, figs. 1, 2. (Woods Bluff, Alabama.)

Test considerably compressed, thickness about half the greatest width, test widening rather rapidly in the majority of specimens, periphery subacute; chambers distinct, earliest few chambers coiled and comprising only the initial angle of the test; later chambers biserial, low and broad in the early portion of the test, gradually increasing in height as added, later chambers slightly inflated; sutures slightly depressed, more distinctly so in the later portion of the test, almost straight, somewhat oblique; wall finely arenaceous, of even texture, and rather smoothly finished; aperture a low arched opening at the base of the apertural face. Length up to 0.46 mm., average 0.28 mm.; width up to 0.24 mm., average 0.19 mm.; thickness up to 0.15 mm., average 0.11 mm.

Hypotype.—Princeton University no. 50761.

Locality.—Station 2.

Remarks.—This small form is identical with that described by Cushman and Ponton from the Wilcox of Ozark, Alabama. It is common in the Salt Mountain limestone, the Bashi and Hatchetigbee formations of Alabama, and the Vincentown formation of New Jersey. It has also been observed in the Nanafalia formation of Alabama, and is

rarely present in the Tuscahoma formation.

Genus TEXTULARIA Defrance, 1824

TEXTULARIA LONTENSIS Lalicker
Plate 78, figure 2

Textularia lontensis LALICKER, *1935*, Cushman Lab. Foram. Research Contr., vol. 11, p. 49, pl. 7, figs. 2, 3. (Eocene, Italy.)

Test large, twice as long as broad, regularly tapering, subovate in end view, periphery rather broadly rounded; chambers indistinct, very slightly inflated in adult portion of test, wider than high; sutures slightly depressed, straight, somewhat oblique; wall coarsely arenaceous; aperture a broad, low opening at the base of the last-formed chamber in a distinct reëntrant. Length up to 1.71 mm.; width up to 0.81 mm.; thickness up to 0.72 mm.

Hypotype.—Princeton University no. 50-762.

Locality.—Station 2.

Remarks.—This form compares closely with the description and figures of Lalicker's species from the upper Eocene of Italy, except that it is somewhat larger. It is common in portions of the Salt Mountain limestone, but is not present in the Wilcox marl at Station 3.

TEXTULARIA PLUMMERAE Lalicker
Plate 78, figure 3

Textularia eocaena PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 67, pl. 3, figs. 2a, b. (Upper Midway, Texas.)

Textularia plummerae LALICKER, *1935*, Cushman Lab. Foram. Research Contr., vol. 11, p. 50, pl. 6, fig. 10. (Upper Midway, Texas.) GLAESSNER, *1937*, Moscow Univ. Publ. Lab. Paleontology, vol. II–III, p. 364. (Lower Tertiary, Caucasus.) CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 52, pl. 9, fig. 4. (Midway group, Alabama.)

Test very elongate, slender, tapering, somewhat compressed, broadly elliptical in end view, periphery broadly rounded; chambers numerous, increasing very slowly in size, about as high as wide, very slightly inflated in the mature portion of the test; sutures slightly depressed, straight, horizontal; wall coarsely arenaceous, roughly finished; aperture an arched opening at the base of the final chamber in a reëntrant in the septal face. Length up to 1.2 mm.; width up to 0.3 mm.

Hypotype.— Princeton University no. 50763.

Locality.—Station 2.

Remarks.—The Alabama specimens resemble the holotype, and topotypes, of Lalicker's species from the upper Midway of Texas. It is not a common species in the Salt Mountain limestone.

Family VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA LAEVIGATA Franke
Plate 78, figures 4, 5

Gaudryina laevigata FRANKE, *1914*, Deutsch. geol. Ges. Zeitschr., vol. 66, p. 431, pl. 27, figs. 1, 2. (U. Cretaceous, Central Europe.) CUSHMAN, *1937*, Cushman Lab. Foram. Research, Spec. Publ. no. 7, p. 41, pl. 6, figs. 10–17. (U. Cretaceous, Central Europe, Texas.)

Test rapidly tapering, subtriangular in outline, maximum width more than two-thirds the length; early portion triserial and triangular in transverse section with narrowly rounded to acute angles; chambers enlarging rapidly; sutures very slightly depressed, horizontal; wall finely arenaceous, smoothly finished; aperture a low elongate arched opening at the inner margin of the last-formed chamber. Length up to 0.74 mm.; width up to 0.55 mm.; thickness up to 0.44 mm.

Hypotype.— Princeton University no. 50764.

Locality.—Station 1.

Remarks.—This short rapidly-tapering *Gaudryina* with a smoothly finished test is one of the most characteristic Foraminifera of the Salt Mountain limestone. It is frequent in the formation except at Station 2 where it is very rare. It is not present in the Wilcox marl bed at Station 3. This species has been reported by Cushman from the Cretaceous Taylor marl of Texas, but it has not been reported from any of the Midway or Wilcox formations in the Gulf Coastal Plain.

Family VALVULINIDAE

Genus EGGERELLA Cushman, 1933

EGGERELLA PLUMMERAE Toulmin, n. sp.
Plate 78, figures 6–8

Test about two and a half times as long as thick, subovoid, gently tapering aborally, broadest near the apertural end; adult stage

triserial, early stage with four or five chambers to a whorl; chambers inflated, rather numerous, elongate, increasing rapidly in length as added; sutures sharply depressed; wall very smoothly finished; aperture an arched slit at the base of the inner margin of the last-formed chamber. Length up to 0.77 mm.; maximum diameter up to 0.29 mm.

Holotype. — Princeton University no. 50765.

Paratype.—Princeton University no. 50766.

Locality.—Wilcox marl bed from Richmond Branch, half a mile north of Salt Mountain. Station 3.

Remarks.—*E. plummerae* resembles figures of *E. subovale* (Schwager), but the adult chambers of *E. plummerae* are proportionately much longer, and the test as a whole is more slender. The species is common in the Salt Mountain limestone, and also in the Wilcox marl at Station 3. The holotype was chosen from the latter locality because of somewhat better preservation. The Salt Mountain specimens are identical, and absolutely no change takes place in the characters of this form between the lower limestone zone and the upper marl zone.

This species was not found in samples collected from any of the well-known Wilcox or Midway outcrops. Its occurrence in both the limestone and in the glauconitic, sandy Wilcox marl indicates that it is not restricted to a definite sedimentary facies. It may prove to be a good zone marker.

Genus EGGERINA Toulmin, n. gen.
Genotype *Eggerina cylindrica* TOULMIN, n. sp.

Test a trochiform[3] spire, with three chambers to a whorl in the adult, the last three chambers making up nearly the whole exterior; wall very finely arenaceous with much calcareous cement, or almost entirely calcareous, smoothly finished; aperture a low arched opening at the inner margin of the last-formed chamber, adjacent to the upper end of an earlier chamber of the final whorl.

Remarks.—This genus is proposed to include *Eggerella*-like structures in which the adult chambers are so strongly embracing as to enclose almost wholly the earlier part of the test. An attempt was made to determine the number of chambers in the early conical portion of the test, but without success. As far as could be determined, the test is triserial throughout, with the possible exception of the small conical portion.

[3] The term trochiform, meaning coiled like *Trochus*, is used in this paper in referring to forms coiled in a conical, spiral manner. The term trochoid really means wheel-like.

EGGERINA CYLINDRICA Toulmin, n. sp.
Plate 78, figures 9–11

Test triserial, consisting of a very small conical early portion, and a nearly cylindrical later portion made up of the last three chambers and composing nearly the entire test; chambers of the early conical portion indistinct, last three chambers somewhat inflated, very elongate, extending almost to the base of the test and embracing strongly all previous chambers; sutures obscure in the early portion, distinct and slightly depressed between the three final chambers; wall very smoothly finished; aperture a simple arched opening at the inner margin of the final chamber, adjacent to the upper end of one of the preceding chambers in the final whorl. Length up to 0.74 mm.; diameter up to 0.4 mm.

Holotype. — Princeton University no. 50767.

Paratype. — Princeton University no. 50768.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—This species is common in the upper portion of the Salt Mountain limestone, but not a single specimen has been found in the Wilcox marl a few feet higher in the section. It has not been observed in any other formation except the Naheola.

Genus MARSSONELLA Cushman, 1933
MARSSONELLA OXYCONA (Reuss)
Plate 78, figures 12, 13

Gaudryina oxycona REUSS, *1860*, Sitz. Akad. Wiss. Wien, vol. 40, p. 229, pl. 12, fig. 3. (U. Cretaceous, Germany.)

Marssonella oxycona CUSHMAN, *1937*, Cushman Lab. Foram. Research, Spec. Publ. no. 8, p. 56, pl. 5, figs. 27–29, pl. 6, figs. 1–17. (U. Cretaceous, Europe, America.) (See this last reference for further synonymy.)

Test trochiform, conical, rapidly and

evenly tapering, circular in transverse section, apertural end flattened, in early stages with four or five chambers to a whorl, later reduced to three and sometimes to two; chambers short, not inflated, simple (not labyrinthic); sutures indistinct, very slightly if at all depressed; wall arenaceous, studded with numerous clear grains, rather smoothly finished; aperture a small semicircular opening at base of the inner margin of the last-formed chamber, near the center of the apertural end of the test. Length up to 1 mm.; maximum diameter up to 0.64 mm.

Hypotype. — Princeton University no. 50769.

Locality.—Station 1.

Remarks.—This very common Salt Mountain species seems to be the same as Reuss' species described from the European Cretaceous. No features were observed that could be used to distinguish it from Cretaceous specimens referred to this species. Sections show as many as four chambers in a whorl in the early portion of the test.

The species is extremely rare in the Wilcox marl bed, Station 3, and has not been found in any other Wilcox outcrops in Alabama. Bagg reported "*Textularia turris* d'Orbigny" from the Vincentown limesand. It may be the same species that is present in

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EXPLANATION OF PLATE 78

All specimens are from the Salt Mountain limestone of Wilcox Eocene age, Clarke County, Alabama, unless otherwise indicated.

FIGS. *1*—*Spiroplectammina wilcoxensis* Cushman and Ponton. Hypotype, Princeton Univ. 50761, from Station 2. ×60. (p. 571)

2—*Textularia lontensis* Lalicker. Hypotype, Princeton Univ. 50762, from Station 2. ×22. (p. 572)

3—*Textularia plummerae* Lalicker. Hypotype, Princeton Univ. 50763, from Station 2. ×25. (p. 572)

4, 5—*Gaudryina laevigata* Franke. Hypotype, Princeton Univ. 50764, from Station 1. ×32. *4*, Side view. *5*, Apertural view. (p. 572)

6–8—*Eggerella plummerae* Toulmin, n. sp. *6, 7*, Opposite sides of holotype, Princeton Univ. 50765, from Wilcox marl bed, Station 3. ×35. *8*, Paratype, Princeton Univ. 50766, from Wilcox marl bed, Station 3. ×35. (p. 572)

9–11—*Eggerina cylindrica* Toulmin, n. sp. *9, 10*, Opposite sides of holotype, Princeton Univ. 50767, from Station 2. ×32. *11* Basal view of paratype, Princeton Univ. 50768, from Station 2. ×55. (p. 573)

12, 13—*Marssonella oxycona* (Reuss). Hypotype, Princeton Univ. 50769, from Station 1. ×30. *12*, Side view. *13*, Apertural view. (p. 573)

14—*Quinqueloculina vulgaris* d'Orbigny. Hypotype, Princeton Univ. 50770, from Station 1. ×65. (p. 576)

15—*Cornuspira* sp. Princeton Univ. 50771, from Station 2. ×65. (p. 576)

16, 17—*Ammocibicides pontoni* Earland. Dorsal and ventral views of specimen from Station 2. ×35. Hypotype, Princeton Univ. 50760. (p. 576)

18—*Robulus austriacus* (d'Orbigny). Hypotype, Princeton Univ. 50772, from Station 2. ×25. (p. 576)

19—*Robulus inornatus* (d'Orbigny). Hypotype, Princeton Univ. 50773, from Station 2. ×22. (p. 577)

20—*Robulus isidis* (Schwager). Hypotype, Princeton Univ. 50774, from Station 2. ×22 (p. 578)

21—*Robulus knighti* Toulmin, n. sp. Holotype, Princeton Univ. 50778 from Station 2. ×22 (p. 578)

22—*Robulus magnificus* Toulmin, n. sp. Holotype, Princeton Univ. 50775, from Station 2. ×15 (p. 578)

23—*Robulus midwayensis* (Plummer). Hypotype, Princeton Univ. 50776, from Wilcox marl bed, Station 3. ×15. (p. 579)

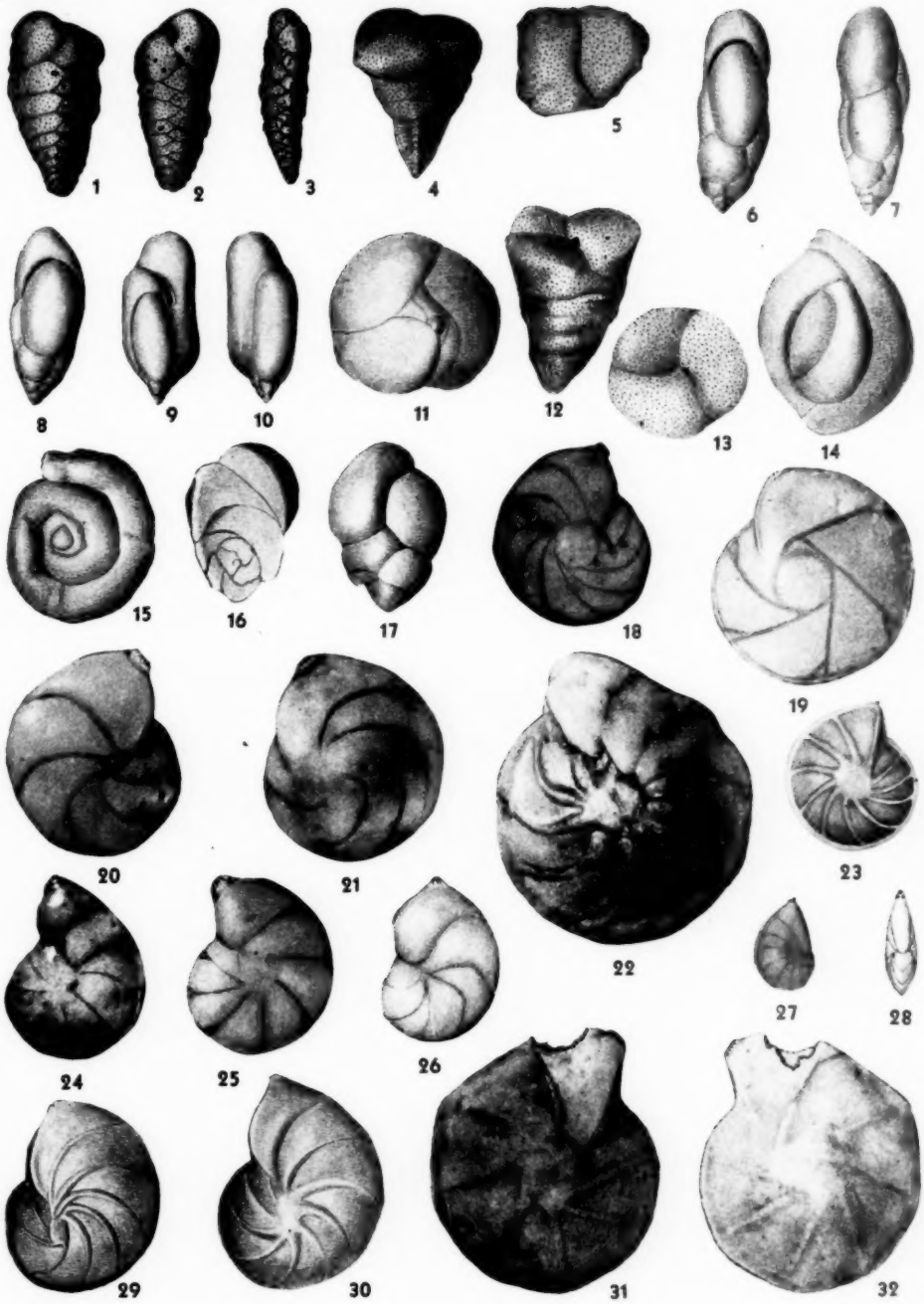
24, 25—*Robulus wilcoxensis* Cushman and Ponton. *24*, Hypotype, Princeton Univ. 50779, from Station 2. ×22. *25*, Hypotype, Princeton Univ. 50780, from Station 2. ×22. (p. 579)

26—*Astacolus navicula* (d'Orbigny). Hypotype, Princeton Univ. 50784, from Station 2. ×25. (p. 580)

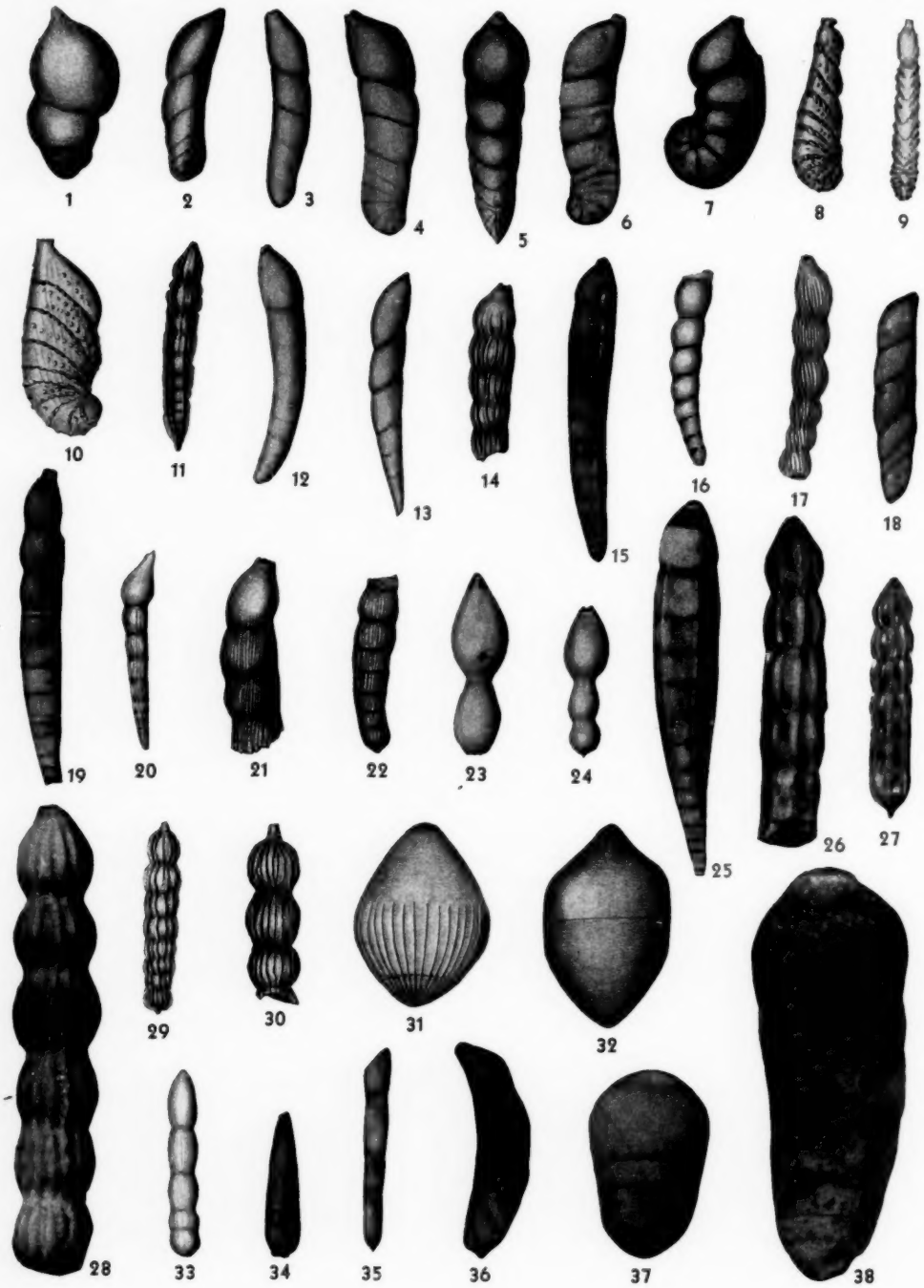
27, 28—*Astacolus jugleri* (Reuss). Hypotype, Princeton Univ. 50781, from Station 2. ×25. (p. 580)

29, 30—*Lenticulina degolyeri* (Plummer). *29*, Hypotype, Princeton Univ. 50782, from Station 2. ×22. *30*, Hypotype, Princeton Univ. 50783, from Station 2. ×20. (p. 580)

31, 32—*Darbyella?* sp. Princeton Univ. 50785, from Station 2. ×22. (p. 581)



Toulmin, Eocene Foraminifera



Toulmin, Eocene Foraminifera

the Salt Mountain limestone. No specimens were found in the Vincentown by the writer.

Marssonella oxycona and other "Cretaceous species" that are found in the Salt Mountain limestone cannot be reworked forms. The limestone in which the tests are found seems to contain no detrital material of terrestrial origin. The limestone was probably deposited in shallow, clear water, an environment indicated by the presence in the limestone of species of reef corals. Arenaceous species such as *Gaudryina laevigata* and *M. oxycona*, if washed out of Cretaceous sediments, would not float out from shore and contribute large numbers to a deposit forming in clear water.

EXPLANATION OF PLATE 79

All specimens are from the Salt Mountain limestone of Wilcox Eocene age, Clarke County, Alabama, unless otherwise indicated.

FIGS. *1*—*Marginulina bullata* Reuss. Hypotype, Princeton Univ. 50786, from Station 2. ×30. (p.581)

2, 3—*Marginulina colligata?* (Reuss). *2*, Hypotype, Princeton Univ. 50787, from Station 2. ×15. *3*, Hypotype, Princeton Univ. 50788, from Station 2. ×*15*. (p. 581)

4–6—*Marginulinopsis wilcoxensis* Toulmin, n. sp. *4, 5*, Holotype, Princeton Univ. 50789, from Station 2. ×15. *6*, Paratype, Princeton Univ. 50790, from Station 2. ×15. (p. 582)

7—*Vaginulinopsis exquisita* Toulmin, n. sp. Holotype, Princeton Univ. 50791, from Station 2. ×50. (p. 583)

8–10—*Vaginulinopsis brantlyi* (Garrett). *8, 9*, Hypotype, Princeton Univ. 50792, from Station 2. ×15. *10*, Hypotype, Princeton Univ. 50793, from Station 2. ×27. (p. 583)

11—*Dentalina alternata* (Jones). Hypotype, Princeton Univ. 50794, from Station 2. ×17. (p. 584)

12—*Dentalina colei* Cushman and Dusenbury. Hypotype, Princeton Univ. 50795, from Station 2. ×25. (p. 584)

13—*Dentalina communis* (d'Orbigny). Hypotype, Princeton Univ. 50796, from Station 2. ×25. (p. 584)

14—*Dentalina confluens* Reuss. Hypotype, Princeton Univ. 50797, from Station 2. ×12. (p. 585)

15—*Dentalina gardnerae* (Plummer). Hypotype, Princeton Univ. 50798, from Station 2. ×15. (p. 585)

16—*Dentalina jacksonensis* (Cushman and Applin). Princeton Univ. 50799, from Station 2. ×32. (p. 585)

17—*Dentalina obliqua* (Linné). Hypotype, Princeton Univ. 50800, from Station 2. ×10. (p. 586)

18—*Dentalina obliquisuturata* Stache. Hypotype, Princeton Univ. 50801, from Station 2. ×25. (p. 586)

19—*Dentalina* cf. *D. pomuligera* Stache. Princeton Univ. 50802, from Station 2. ×15. (p. 586)

20—*Dentalina semilaevis* Hantken. Hypotype, Princeton Univ. 50803, from Station 2. ×20. (p. 587)

21, 22—*Dentalina* cf. *D. fissicostata* Gümbel. Princeton Univ. 50804, from Station 2. ×20. (p. 587)

23, 24—*Dentalina soluta* Reuss. Hypotype, Princeton Univ. 50805, from Station 2. ×25. (p. 587)

25—*Dentalina vertebralis* (Batsch). Hypotype, Princeton Univ. 50806, from Wilcox marl bed, Station 3. ×22. (p. 587)

26, 27—*Nodosaria latejugata* Gümbel. *26*, Hypotype, Princeton Univ. 50807, from Station 2. ×10. *27*, Hypotype, Princeton Univ. 50808, from Wilcox marl bed, Station 3. ×10. (p. 588)

28—*Nodosaria latejugata* Gümbel var. *carolinensis* Cushman. Hypotype, Princeton Univ. 50809, from Station 2. ×10. (p. 588)

29, 30—*Nodosaria paupercula* Reuss. *29*, Hypotype, Princeton Univ. 50810, from Wilcox marl bed, Station 3. ×32. *30*, Hypotype, Princeton Univ. 50811, from Station 2. ×32. (p. 588)

31—*Pseudoglandulina comata* (Batsch). Hypotype, Princeton Univ. 50813, from Wilcox marl bed, Station 3. ×65. (p. 589)

32—*Pseudoglandulina manifesta?* (Reuss). Princeton Univ. 50812, from Wilcox marl bed, Station 3. ×65. (p. 590)

33—*Chrysalogonium tenuicostatum* Cushman and Bermudez. Hypotype, Princeton Univ. 50814, from Station 2. ×25. (p. 589)

34, 35—*Chrysalogonium granti* (Plummer). Hypotypes, Princeton Univ. 50815, from Station 2. ×25. (p. 589)

36—*Vaginulina* sp. Princeton Univ. 50818, from Station 2. ×25. (p. 592)

37, 38—*Lingulina wilcoxensis* Cushman and Ponton. Hypotypes, from station 2. ×15. *37*, Princeton Univ. 50816. *38*, Princeton Univ. 50817. (p. 591)

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

QUINQUELOCULINA VULGARIS d'Orbigny
Plate 78, figure 14

Quinqueloculina vulgaris D'ORBIGNY, *1826*, Ann. Sci. Nat., vol. 7, p. 302, no. 33. CUSHMAN, *1929*, U. S. Nat. Mus. Bull. 104, pt. 6, p. 25, pl. 2, figs. 3a–c. (Recent, Atlantic Ocean.)

Specimens of a short, stout *Quinqueloculina* are frequent in the Salt Mountain limestone. They are almost orbicular in front view and the periphery is rounded. They probably belong to this species of d'Orbigny which is a stouter species than *Q. seminulum* (Linné). Length up to 0.42 mm.; width up to 0.33 mm.; thickness up to 0.26 mm.

Hypotype.—Princeton University no. 50770.

Locality.—Station 1.

Family OPHTHALMIDIIDAE

Genus CORNUSPIRA Schultz, 1854

CORNUSPIRA sp.
Plate 78, figure 15

Specimens of a small, slightly involute *Cornuspira* are rarely present in the limestone. The test is nearly circular in outline and the periphery is rounded. The primordial chamber is comparatively large and the number of convolutions averages about four. Diameter up to 0.31 mm.

Depository.—Princeton University no. 50771.

Locality.—Station 2.

Family TROCHAMMINIDAE

Genus AMMOCIBICIDES Earland, 1934

AMMOCIBICIDES PONTONI Earland
Plate 78, figures 16, 17

Cibicides semiplectus CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 72, pl. 9, figs. 12, 13. (Ozark, Alabama.)

Ammocibicides pontoni EARLAND, *1934*, Discovery Repts., vol. 10, p. 107, pl. 4, figs. 8–12. (Ozark, Alabama). CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 89.

Test plano-convex or concavo-convex, frequently elongate, attached in life; dorsal side flat, concave, or irregular, taking the shape of the object to which the individual was attached; ventral side convex, periphery acute; early chambers arranged in a flattened evolute spiral consisting of two convolutions of about four chambers each; later chambers added in a uniserial or biserial manner, usually two in number and comprising about half the test; chambers somewhat inflated and distinct on the ventral side; dorsal sutures indistinct, not depressed; ventral sutures distinct and depressed; arenaceous wall smoothly finished, but not polished, composed of fine indistinct grains; aperture, when present, a slit on the peripheral edge of the final chamber. Length 0.55–0.83 mm., width 0.37–0.46 mm., thickness 0.46 mm.

Hypotype.—Princeton University no. 50760

Locality.—Station 2.

Remarks.—This is a common and distinctive species throughout the Salt Mountain limestone. It was not observed in the Wilcox marl bed overlying the limestone at Station 3. A few specimens were found adhering to echinoid spines to which they were attached in life. Most of the specimens from the Wilcox at Ozark, Alabama, have a flat dorsal side, but those from the Salt Mountain limestone have a dorsal side varying in shape and indicating attachment to a variety of objects. This species is known only from the Salt Mountain limestone and the upper Wilcox at Ozark, Alabama.

Family LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS AUSTRIACUS (d'Orbigny)
Plate 78, figure 18; text figure 2A

Robulina austriaca D'ORBIGNY, *1846*, Foram. Foss. Bass. Tert. Vienne, p. 103, pl. 5, figs. 1, 2. (Miocene, Austria.)

Cristellaria austriaca REUSS, *1865*, K. Akad. Wiss. Wien, Denkschr., vol. 25, p. 144.

Robulus austriaca CUSHMAN and SCHENK, *1928*, Univ. California Dept. Geol. Sci., Bull. vol. 17, p. 307, pl. 42, fig. 4. (Tertiary, Oregon.)

Test moderately compressed, the thickness being about half the diameter, close coiled, periphery sharply angled, somewhat ragged in a few specimens; chambers, 10 or 12 in the last coil, gradually increasing in size as added, of uniform curved shape; sutures distinct, strongly curved, flush with the surface, radiating outward from a dis-

tinct broad, smooth umbo; wall smooth; aperture radiate with robuline slit, slightly protruding, at the peripheral angle of the last chamber. Diameter up to 1.3 mm.; thickness up to 0.57 mm.

Hypotype.—Princeton University no. 50772.

Locality.—Station 2.

Remarks.—The Salt Mountain specimens are very similar to topotypes of *R. austriacus* from the Vienna Basin except that the former have a sharper peripheral angle. The topotypes have 12 or 13 chambers and a narrow flange. In general the Alabama specimens come within the range of individual variation shown by the topotypes themselves.

ROBULUS INORNATUS (d'Orbigny)
Plate 78, figure 19; text figure 2B

Robulina inornata D'ORBIGNY, *1846*, Foram. Foss. Bass. Tert. Vienne, p. 102, pl. 4, figs. 25, 26. (Miocene, Austria.)

Cristellaria inornata CUSHMAN and G. D. HANNA, *1927*, California Acad. Sci. Proc., ser. 4, vol. 16, p. 217, pl. 14, fig. 5. (Eocene, California.) NUTTALL, *1932*, Jour. Paleontology, vol. 6, p. 10. (Oligocene, Mexico.) PALMER and BERMUDEZ, *1936*, Soc. Cubana Hist. Nat. Mem., vol. 10, no. 4, p. 249. (Oligocene, Cuba.)

Robulus inornatus CUSHMAN and BARKSDALE, *1930*, Stanford Univ. Dept. Geol. Contr., vol, 1, no. 2, p. 62, pl. 11, figs. 2, 3. (Eocene, California.)

Test large, somewhat compressed, the thickness being about two-thirds the diameter, very closely coiled, periphery with a bluntly acute keel; chambers six to eight on the last coil, gradually increasing in size, of uniform subtriangular shape; sutures distinct, limbate, straight or very gently curved, flush with the surface, tangent to the large central umbo; wall smooth; aperture at the outer peripheral angle of the last chamber, radiate with a supplementary robuline slit. Diameter up to 1.45 mm.; thickness up to 0.77 mm.

Hypotype.—Princeton University no. 50773.

Locality.—Station 2.

Remarks.—This species is common in portions of the limestone. *? Robulus inornatus* d'Orbigny figured by Israelsky (1939, p. 573, pl. 3, fig. 1) from the Eocene of California is similar, but has a larger number of chambers in the final whorl.

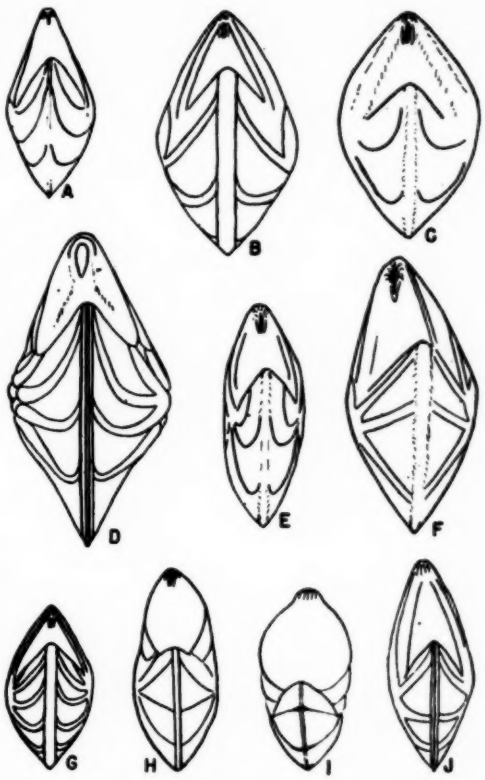


FIG. 2.—*A*, *Robulus austriacus* (d'Orbigny). Hypotype, Princeton Univ. 50772, from Station 2. ×25. (p. 576)
B, *Robulus inornatus* (d'Orbigny). Hypotype, Princeton Univ. 50773, from Station 2. ×22. (p. 577)
C, *Robulus knighti* Toulmin, n. sp. Holotype, Princeton Univ. 50778, from Station 2. ×22. (p. 578)
D, *Robulus magnificus* Toulmin, n. sp. Holotype, Princeton Univ. 50775, from Station 2. ×15. (p. 578)
E, *Robulus isidis* (Schwager). Hypotype, Princeton Univ. 50774, from Station 2. ×22. (p. 578)
F, *Darbyella*? sp. Princeton Univ. 50785, from Station 2. ×22. (p. 581)
G, *Robulus midwayensis* (Plummer). Hypotype, Princeton Univ. 50776, from Wilcox marl bed, Station 3. ×15. (p. 579)
H, *Robulus wilcoxensis* Cushman and Ponton. Hypotype, Princeton Univ. 50779, from Station 2. ×22. (p. 579)
I, *Astacolus navicula* (d'Orbigny). Hypotype, Princeton Univ. 50784, from Station 2. ×25. (p. 580)
J. *Lenticulina degolyeri* (Plummer), Hypotype, Princeton Univ. 50782, from Station 2. ×22. (p. 580)

ROBULUS ISIDIS (Schwager)
Plate 78, figure 20; text figure 2E

Cristellaria isidis SCHWAGER, *1883*, Palaeontographica, vol. 30, Pal. Theil, p. 110, pl. 26 (3), figs. 12a–c. (Eocene, Egypt.)
Robulus isidis CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 52, pl. 7, figs. 2a, b. (Ozark, Alabama.)

Test considerably compressed, the thickness being about two-fifths the diameter, close coiled, periphery bluntly angled; chambers five or six in the final whorl, increasing slightly in size as added, of uniform curved shape; sutures distinct, gently curved, slightly depressed between the later chambers; aperture at the peripheral angle of the last chamber, radiate with a robuline slit. Diameter up to 1.23 mm.; thickness up to 0.52 mm.

Hypotype.—Princeton University no. 50774.

Locality.—Station 2.

Remarks.—This species has been found in the limestone at Station 2 only.

ROBULUS KNIGHTI Toulmin, n. sp.
Plate 78, figure 21; text figure 2C

Test full-bodied, the thickness being about two-thirds the diameter, close coiled, periphery angled, with a very indistinct blunt keel; chambers about six in the last-formed coil, increasing rapidly in size as added; sutures indistinct, flush with the surface, very strongly curved; wall smooth; apertural face broad, aperture at the outer peripheral angle of the last-formed chamber, radiate with a supplementary robuline slit in the apertural face. Average diameter 1.2 mm.; average thickness 0.7 mm.

Holotype.—Princeton University no. 50778.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—This species is frequent throughout the Salt Mountain limestone. It was not found in the Midway or Wilcox collections of the writer and is not close to any form reported from the Midway of Texas by Plummer nor from the upper Wilcox of Alabama by Cushman and Ponton. In the Salt Mountain limestone all the tests have been replaced by calcite and are opaque. A somewhat similar form was described by Reuss in 1863 from the Tertiary of Germany and given the name *Robulina subangulata*. Previously Reuss had used the name *Cristellaria subangulata* in describing a new species from the Cretaceous of north Germany. Judging from the original figures the two species are different. The Tertiary form is *Robulus* and the Cretaceous form is apparently *Lenticulina*. The Alabama form differs from "*Robulina subangulata*," as originally figured, in having more strongly curved sutures, fewer chambers, a more inflated final chamber, and a less protuberant aperture. *R. knighti* is similar to *R. depauperata* (Reuss), 1851, in several respects, but it is larger and comparatively much thicker than Reuss' species.

ROBULUS MAGNIFICUS Toulmin, n. sp.
Plate 78, figure 22; text figure 2D

Test large, moderately compressed, the thickness being about half the diameter, close coiled except in the region of the last one or two chambers in the adult where it may become slightly uncoiled, periphery with a distinct thickened keel becoming obsolete on the final chambers in the adult; chambers nine or ten in the adult, gradually increasing in size as added, of rather uniform curved shape; sutures distinct, curved, limbate and strongly raised, increasing in thickness toward the inner end and merging into the umbo on the early part of last whorl, but not quite meeting the umbo on the later part of the final whorl of some specimens, sutures depressed between the last two or three chambers in the adult; wall smooth except for the raised sutures; aperture at the peripheral angle of the last chamber, radiate, with a robuline slit. Average diameter 2.4 mm.; thickness 1.4 mm.

Holotype.—Princeton University no. 50775.

Locality.—Salt Mountain limestone from Richmond Branch half a mile north of Salt Mountain in the NW ¼ NW ¼ sec. 34, T. 6N., R. 2E. Station 2.

Remarks.—This species closely resembles *Robulus spisso-costatus* Cushman from the Corsicana marl of Upper Cretaceous age. Both species have strongly limbate and raised sutures, and they become slightly evolute in the adult stage. *Robulus magnificus*

differs from *R. spisso-costatus* in being much larger and in having depressed sutures between the last two or three slightly uncoiled adult chambers. It differs from *Robulus navarroensis* (Plummer) var. *extruatus* Cushman in being larger, and in lacking the wide thin keel. Also the shape of the test is somewhat different in the two species. In peripheral view the outline of the test of *R. magnificus* is slightly concave between the umbo and the periphery, but in the variety *extruatus* the outline of the test is gently convex between the umbo and the periphery. *R. magnificus* is common at Station 2 and is frequent at Station 3 but has not been found anywhere else.

ROBULUS MIDWAYENSIS (Plummer)
Plate 78, figure 23; text figure 2G

Cristellaria midwayensis PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 95, pl. 13, figs. 5a–c. (Midway group, Texas.)
Lenticulina midwayana ISRAELSKY, *1939*, Proc. Sixth Pacific Sci. Cong., p. 573, pl. 2, figs. 7, 8. (Eocene, California.)
Robulus midwayensis CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 54, pl. 9, fig. 12. (Midway group, Alabama.)

Test large, somewhat compressed, the thickness being about three-fifths the diameter, almost circular in outline, closely coiled, periphery with a bluntly rounded keel; chambers 10 to 12 in the last coil, of uniform gently-curved shape, gradually increasing in size; sutures distinct, limbate, raised, of clear shell material, radiating outward in a gentle curve from a conspicuous central smooth boss; wall smooth except for the raised sutures; aperture at the peripheral angle of the last chamber, radiate with a supplementary ventral slit. Average diameter 1.4 mm,; average thickness 0.85 mm.

Hypotype.—Princeton University no. 50776.

Locality.—Station 3.

Remarks.—This distinctive species is common in the Midway of Texas and Alabama. It is also common in the Nanafalia formation of lower Wilcox age in Alabama, but is not present in the Bashi formation of upper Wilcox age. *R. midwayensis* is not present in the Salt Mountain limestone except in its uppermost portion at Richmond Branch. It is the most abundant species in the Wilcox marl, Station 3, just above the Salt Mountain limestone.

ROBULUS WILCOXENSIS Cushman and Ponton
Plate 78, figures 24, 25; text figure 2H

Robulus wilcoxensis CUSHMAN and PONTON, *1932*, Contr. Cushman Lab. Foram. Res., vol. 8, p. 52, pl. 7, figs. 3a, b. (Wilcox group, Ozark, Alabama.)

Test moderately compressed, the thickness being about two-fifths the longest diameter, closely coiled except toward the end in the adult where the last two or three chambers may become uncoiled, periphery rather sharply angled but not keeled, becoming more broadly rounded on the uncoiled chambers; chambers eight or nine in the last coil, last few chambers in mature specimens slightly inflated and uncoiled, early ones of uniform shape; sutures distinct, gently curved, flush with the surface in the early portion of the coil, becoming slightly depressed between the later chambers in the uncoiled portion; wall smooth; aperture radiate with a robuline slit, terminal in the adult. Length up to 1.52 mm.; width up to 1.32 mm.; thickness up to 0.48 mm.

Hypotypes.—Princeton University nos. 50779, 50780.

Locality.—Station 2.

Remarks.—This form has been found only in the limestone in the Salt Mountain area, where it is common. The specimens are a little larger than the holotype of the species in Cushman's collection, and the early sutures are not raised. In other respects the Salt Mountain specimens are very similar to the holotype. It is common in the upper Midway limestone of Ft. Gaines.

Genus ASTACOLUS Montfort, 1808

Galloway (1933, p. 237) gives the following description of the genus *Astacolus:*

Genotype, *Astacolus crepidulus* (Fichtel and Moll) = *Astacolus crepidulatus* Montfort, Conch. Syst., vol. 1, 1808, p. 262, fig., renamed from *Nautilus crepidulus* Fichtel and Moll, Test. Micr., 1798, p. 107, pl. 19, figs. g–i. (Recent, coast near Leghorn, Italy.)—Galloway and Wissler, Jour. Pal., vol. 1, 1927, p. 45.

Test free, planispiral, involute in the early portion and evolute in the later portion, par-

ticularly the outer margin, with the chambers very oblique and reaching back, or nearly back, to the involute portion; surface smooth; periphery usually without carina; wall very finely perforate; aperture terminal, at the outer end of the last chamber, round, radiate. Length up to 1.4 mm.—Jurassic to Recent.

Remarks.—The genus *Lenticulina* is typically completely involute, whereas the later portion of the test of the genus *Astacolus* is somewhat evolute. The chambers of this portion do not reach back to the center of the test, but usually do embrace the periphery of the previous coil. The aperture is similar to that of *Lenticulina*, without the supplementary median slit in the apertural face. Forms having the robuline slit are all referred to the genus *Robulus* in this paper. Critellarian forms lacking the robuline slit are referred to *Lenticulina* if the test is involute throughout, or to *Astacolus* if the later portion of the test becomes somewhat evolute. Cristellarian forms from the Salt Mountain limestone are well preserved and the apertural details can be easily observed.

The enlarged median robuline slit is a character that possibly should not be given generic weight. The determination of minute apertural details is difficult or impossible in many cases, so that it is often impracticable to distinguish the genus *Robulus*. This is especially true of fossil specimens. Thalmann (1937, pp. 342–344) suggests the use of the comprehensive genus *Cristellaria* Lamarck, 1816, and the designation of the subgenus *Robulus* or *Lenticulina* where the apertural details can be discerned. Plummer (1931, pp. 140, 141) does not use the genus *Robulus*.

ASTACOLUS JUGLERI (Reuss)
Plate 78, figures 27, 28

Cristellaria jugleri REUSS, *1851*, Zeit. deutsch. geol. Gesell., vol. 3, p. 89, pl. 4, figs. 19a, b. (Oligocene, Germany.)

Specimens of the type of test figured are present in the limestone and marl in the Salt Mountain area. They are considerably compressed, have a sharply angled periphery, and have eight or nine chambers. They are quite similar to figures of *Robulus mayi* Cushman and Parker, but a study of the holotype of that species shows that this Wilcox form is different, in that its apertural face is narrower and more rounded, and its aperture is without the supplementary robuline slit. The later chambers extend back to the periphery of the coiled portion, and the test never becomes as completely evolute as that of *A. crepidulus* (Fichtel and Moll). Length up to 0.7 mm.; width up to 0.46 mm.; thickness 0.24 mm.

Hypotype.—Princeton University no. 50781.

Locality.—Station 2.

ASTACOLUS NAVICULA (d'Orbigny)
Plate 78, figure 26; text figure 2I

Cristellaria navicula D'ORBIGNY, *1840*, Soc. Géol. France Mém., ser. 1, vol. 4, p. 27, pl. 2, figs. 19, 20. (U. Cretaceous, France). REUSS, *1845–46*, Verstein. Böhm. Kreide, pt. 1, p. 35, pl. 12, fig. 27. (U. Cretaceous, Central Europe.)
Lenticulina navicula CUSHMAN and JARVIS, *1932*, U. S. Nat. Mus., Proc., vol. 80, art. 14, p. 24, pl. 7, figs. 5a, b. (U. Cretaceous, Trinidad.)

Test somewhat elongate, moderately compressed, the thickness through the early coil being half the greatest diameter; early portion closely coiled, later portion becoming evolute, periphery acute; chambers seven or eight in number, later chambers very slightly inflated and thickening rapidly; sutures distinct, moderately curved, slightly depressed in the mature portion of the test; wall smooth, polished; apertural face very tumid, aperture radiate, produced, at the outer peripheral angle. Length 0.88 mm.; width 0.64 mm.; thickness, 0.44 mm.

Hypotype.—Princeton University no. 50784.

Locality.—Station 2.

Remarks.—This is a common species in portions of the Salt Mountain limestone, but not in the Wilcox marl bed at Station 3.

Genus LENTICULINA Lamark, 1804

LENTICULINA DEGOLYERI (Plummer)
Plate 78, figures 29, 30; text figure 2J

Cristellaria degolyeri PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 97, pl. 7, figs. 7a, b. (Midway group, Texas.)
Lenticulina degolyeri JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 174, pl. 1, figs. 17a, b. (U. Cretaceous, New Jersey.)

Test moderately compressed, the thickness being about two-fifths the longest diameter, longer than broad, closely coiled except toward the end in the adult where it may

become slightly uncoiled, periphery sharply angled, with a very narrow sharp flange; chambers 9–10 in the final whorl, gradually increasing in size as added, of uniform curved shape; sutures of clear shell material, distinct, curved, limbate, and raised, gradually thickening toward the inner end and merging to form an umbonal boss; wall smooth except for the raised sutures; aperture radiate at the peripheral angle of the final chamber. Dimensions of average specimen: length 1.2 mm.; width 0.96 mm.; thickness 0.48 mm.

Hypotypes.—Princeton University nos. 50782, 50783.

Locality.—Station 2.

Remarks.—This species is very common in the upper portion of the Salt Mountain limestone at Richmond Branch. It is less mineralized than any other species in this formation. It is also common in the Wilcox marl bed at Station 3. It has not been observed in any other Wilcox formation in Alabama, but it is common in the Midway group. The form figured by Cushman (1940, p. 55) under the name *Robulus pseudomamilligerus* (Plummer) seems to be this species. A very similar form, *Lenticulina* sp., has been figured by Israelsky (1939, p. 572, pl. 2, figs. 4, 5) from the Eocene of California.

Genus DARBYELLA Howe and Wallace, 1933

DARBYELLA? sp.

Plate 78, figures 31, 32; text figure 2F

Test large, moderately compressed, the thickness being about half the diameter, closely coiled, adult chambers at one side of the previous plane of coiling, periphery with a narrow blunt keel; chambers seven or eight in number, gradually increasing in size as added, of uniform shape; sutures distinct, almost straight, radiating outward from a large central umbo, flush with the surface; wall smooth; aperture radiate, at the outer peripheral angle of the final chamber. Dimensions of average specimen: diameter 1.45 mm.; thickness 0.83 mm.

Depository.—Princeton University no. 50785.

Locality.—Station 2.

Remarks.—This large form is not common in the Salt Mountain limestone, but it is rather common in the Wilcox marl a few feet higher in the section. It may be an abnormal form of *Robulus*. Except for the unusual type of coiling, it is very similar to specimens that have been referred to *Robulus alato-limbatus* (Gümbel).

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA BULLATA Reuss

Plate 79, figure 1

Marginulina bullata REUSS, *1845–46*, Verstein. Böhm. Kreide, pt. 1, 1845, p. 29, pl. 13, figs. 34–38. (U. Cretaceous, Central Europe.) CUSHMAN, *1937*, Cushman Lab. Foram. Research Contr., vol. 13, p. 96, pl. 14, figs. 9–15. (U. Cretaceous, Texas.)

The specimens from the Salt Mountain limestone seem to be the same as Reuss' species. The chambers are few in number and strongly inflated. The sutures are depressed and the aperture is distinctly protuberant and radiate, but not at the end of a cylindrical neck. Length up to 0.81 mm.; diameter 0.42 mm.

Hypotype.—Princeton University no. 50786.

Locality.—Station 2.

MARGINULINA COLLIGATA? (Reuss)

Plate 79, figures 2, 3

Dentalina colligata REUSS, *1861* (*1862*), Sitz. Akad. Wiss. Wien, vol. 44, p. 334, pl. 7, fig. 4. (Eocene?, New Jersey.)

Test very elongate, arcuate, circular in transverse section; early coil composed of a very few indistinct chambers; later rectilinear chambers distinct, oblique, somewhat inflated, about as long as broad, final chamber much inflated, longer than broad; sutures oblique, in the early portion of the test indistinct, flush with the surface, in the later portion distinct, depressed; wall smooth; aperture radiate, eccentric, somewhat produced. Length up to 2.88 mm.; diameter up to 0.5 mm.

Hypotypes.—Princeton University nos. 50787, 50788.

Locality.—Station 2.

Remarks.—This distinctive *Marginulina* is common in the Salt Mountain limestone, but it is not present in the Wilcox marl bed above. It differs from *M. attenuata* Neugeboren from the Tertiary of Europe in having less oblique sutures. It is referred to Reuss' species from the "senonischen Grünsandes"

(Vincentown formation?) of New Jersey with some question. In outline and in the character of the adult chambers and sutures, it is identical with Reuss' figure. In Reuss' figure the shape of the initial end is *Marginulina*-like, but no coiled chambers are shown. In all the Salt Mountain specimens mineralization of the test makes it very difficult to distinguish the early coiled chambers, and in a large proportion of the specimens the early coiled chambers cannot be observed at all. Reuss in his description states: "An manche *Marginulina*-Arten sich annahernd. Wenig gebogen, unten stumpf, mit 6 bis 7 Kammern, deren erste klein, gerundet und kaum grosser als die nachstfolgende ist, von welcher sie ausserlich nicht gesondert erscheint."

Genus MARGINULINOPSIS Silvestri, 1904

Genotype, *Marginulinopsis densicostata* THALMANN, 1937. [=*Marginulina costata* (Batsch), of Brady, 1884, not Batsch, 1791.] Recent, north of St. Thomas, Culebra Island, West Indies, 390 fathoms.

Early portion of the test compressed, later portion not compressed and circular in transverse section in full maturity; early chambers close coiled, later chambers added in a rectilinear series; wall calcareous, very finely perforate; aperture radiate. Jurassic to Recent.

Remarks.—This genus was proposed by Silvestri (1904, p. 253) and includes those species having an early portion that is close coiled and a later noncompressed portion composed of rectilinear chambers as in *Marginulina*. Silvestri did not designate a genotype in 1904, but in 1911 named *Marginulina costata* (Batsch), of Brady, 1884, as the genotype.[4] Thalmann (1937) discussed the genus *Marginulinopsis* in 1937 and appended a list of species, several of which he described as new. The genotype was given the name *Marginulinopsis densicostata* Thalmann, 1937, and Brady's figure was reproduced.

MARGINULINOPSIS WILCOXENSIS Toulmin, n. sp.

Plate 79, figures 4–6

Test very elongate, compressed in early portion, gradually becoming uncompressed with advanced development; early compressed coil composed of about four distinct chambers making up about half a convolution; later stage composed of several rectilinear and somewhat oblique chambers disposed along an almost straight axis, becoming circular in transverse section and more inflated in full maturity; sutures distinct, slightly curved and flush with the surface in the coiled portion of the test, nearly at right angles to the elongate axis in the rectilinear portion and becoming more depressed between the later chambers; wall smooth; aperture radiate, at the outer peripheral angle. Length up to 1.53 mm.; width up to 0.44 mm.; maximum thickness up to 0.44 mm.

Holotype.—Princeton University no. 50789.

Paratype.—Princeton University no. 50790.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—This is a common species in the Salt Mountain limestone. It resembles somewhat the upper Wilcox specimens from Ozark, Alabama, referred to *Marginulina dubia* (?) Neugeboren, except that the coiled portion is more compressed in this species.

This species differs from specimens of *Marginulinopsis bachei* (Reuss) in being smaller and in having a relatively smaller, less inflated proloculum. The periphery is sharply angled throughout the coiled portion in the Wilcox form. In the Recent *M. bachei* the proloculum is not angled. Tests of the species *M. wilcoxensis* are shorter and have a smaller number of inflated adult chambers. The aperture in all specimens observed was located at the extreme outer peripheral angle, but in *M. bachei* it is almost terminal in many specimens.

Genus VAGINULINOPSIS Silvestri, 1904

Genotype, *Vaginulinopsis inversa* (Costa, 1856) var. *carinata* A. SILVESTRI, 1899. Mio-Pliocene of Bonfornello (Palermo), Sicily.

Test compressed throughout, oval to elliptical in transverse section; early chambers close coiled, later chambers added in a rectilinear series; wall calcareous, very finely

[4] Pont. accad. sci. Nuovi Lincei Atti, anno 64, footnote 1, p. 179, 1911.

perforate; aperture radiate. Jurassic to Recent.

Remarks.—This genus was proposed by Silvestri (1904). It includes those species having an early portion with close coiled chambers and a later portion with chambers in a rectilinear series as in *Vaginulina*. Silvestri named as the genotype *Vaginulina soluta* A. Silvestri, 1899, var. *carinata* A. Silvestri, 1899.[5] Later Silvestri (1904) considered *Vaginulina soluta* to be a synonym of *Marginulina inversa* Costa, 1856. Thalmann (1937) discussed the genus *Vaginulinopsis*, redescribed the genotype and reproduced the original figure, and appended a list of species.

VAGINULINOPSIS EXQUISITA Toulmin, n. sp.
Plate 79, figure 7

Test elongate, much compressed, peripheral margin acutely keeled; chambers 8 or 10 in number, early coil composed of five to seven chambers followed by a few chambers in an oblique series that are wider than high, very slightly inflated in later portion of test; sutures distinct, gently curved, flush with the surface in the coiled portion of the test, slightly depressed and oblique in the later portion; wall smooth; aperture at the outer peripheral angle, slightly protruding. Length up to 0.64 mm.; width up to 0.20 mm.; thickness 0.15 mm.

Holotype.—Princeton University no. 50791.

Locality.—Station 2.

Remarks.—This is a rare species in the Salt Mountain limestone. Fully developed specimens have as many as four or five chambers in the somewhat arcuate uncoiled portion of the test. It is more compressed than *Cristellaria scitula* Berthelin, of Plummer (1927, p. 100), from the Wills Point formation of Texas. It differs from *Vaginulinopsis hauerina* (d'Orbigny) from the Miocene of the Vienna Basin in having a keeled peripheral margin.

VAGINULINOPSIS BRANTLYI (Garrett)
Plate 79, figures 8–10

Hemicristellaria brantlyi GARRETT, *1941*, Jour. Paleontology, vol. 15, p. 154, pl. 26, figs. 1–4. (Nanafalia formation, Alabama.)

Test elongate, much compressed tubercu late; early coil composed of five to six rapidly broadening coiled chambers followed by several rectilinear chambers that rapidly become typically vaginuline; sutures distinct, gently curved in early coil, oblique to the axis of the rectilinear sequence of late chambers, elevated and ornamented by numerous small tubercles of clear material, tubercles most prominent in the early portion of the test, absent on the latest portion of some very mature specimens, sutures between the last two or three chambers of the test of very mature specimens depressed; aperture radiate, protruding, at the outer peripheral angle. Length up to 1.66 mm., average 0.92 mm.; width up to 0.46 mm., average 0.44 mm.; thickness up to 0.26 mm., average 0.22 mm.

Hypotype.—Princeton University no. 50792, 50793.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—Elongate tuberculate forms of this general type are common throughout the Salt Mountain limestone and are also common in the Wilcox marl at Station 3. They show distinct variations from the lower limestone zone to the upper marl zone. They resemble *Vaginulinopsis echinata* Thalmann from the upper Midway of Texas, *V. asperuliformis* (Nuttall) from the Aragón (Eocene) of Mexico, and *V. asperula* (Gümbel) from the lower Eocene of Upper Bavaria, but they differ from all these in having sutures that are more oblique to the axis in the mature portion of the test and make a distinct curve downward toward the coil as they approach the ventral periphery. In addition the specimens from (Station 2) are much more compressed than *V. echinata*, and the periphery is rounded in the mature portion, not bluntly angular as in *V. echinata*. The specimens are equally compressed in the coiled and the mature portions of the test.

The specimens from the Wilcox marl at Richmond Branch, Station 3, can readily be distinguished from the specimens from the limestone. The specimens from Station 3 are thicker and the periphery is more bluntly angled. In these respects they resemble *V. echinata*, but they differ in having a more compressed coiled portion with a bluntly

[5] Pont. accad. sci. Nuovi Lincei Mem., vol. 15, p. 166, pl. 2, fig. 7, 1899.

angled periphery. The coiled portion of *V. echinata* has a broadly rounded periphery. The coiled portion of *V. asperuliformis* is compressed, and the Wilcox specimens somewhat resemble that species. The periphery of *V. asperuliformis* is sharp with a thin narrow keel. The periphery is sharp in some of the specimens from Station 3, but a distinct keel is rarely present. The bead-like ornamentation also seems to be much coarser and heavier on *V. asperuliformis*. *Hemicristellaria* sp. figured by Israelsky (1939, p. 574, pl. 3, figs. 6, 7) from the Eocene of California seems to be the same as the form from the Wilcox marl at Station 3.

Genus DENTALINA d'Orbigny, 1826

DENTALINA ALTERNATA (Jones)

Plate 79, figure 11

Nodosaria zippei var. *alternata* JONES, *1884–85*, in Wright, Belfast Nat. Field Club Proc., Appendix 9, pt. 4, p. 330, pl. 27, fig. 10. (U. Cretaceous, Ireland.)

Nodosaria alternata CARSEY, *1926*, Univ. Texas Bull. 2612, p. 35, pl. 4, fig. 7. (U. Cretaceous, Texas.)

Dentalina alternata PLUMMER, *1931*, Univ. Texas Bull. 3101, p. 153, pl. 9, fig. 7. (U. Cretaceous, Texas.) SANDIDGE, *1932*, Jour. Paleontology, vol. 6, p. 274, pl. 42, fig. 6. (U. Cretaceous, Alabama.)

Nodosaria affinis CUSHMAN [part], *1931*, Jour. Paleontology, vol. 5, p. 305, pl. 35, fig. 2 [not 3–5]. (U. Cretaceous Arkansas.)

Test straight to slightly arcuate, rather stout, of nearly uniform diameter throughout, apical end rounded and with a short spine; chambers about as broad as long, about 10 in number, uninflated except the last two or three; sutures not depressed except between the last few chambers; surface ornamented with 10 or 12 high sharp thin costae extending the length of the test, continuous across the chambers, with lower less conspicuous costae between; aperture terminal, protruding. Diameter 0.3 mm.; length up to 1.73 mm.

Hypotype.—Princeton University no. 50794.

Locality.—Station 2.

Remarks.—This species was originally described from the Cretaceous of Ireland. It has been reported from the Upper Cretaceous of Texas and Alabama. The Eocene specimens seem to be identical with specimens figured from the Cretaceous. In the Salt Mountain area this species has been observed in the limestone only. It is rarely present in samples of Sucarnoochee clay collected from an exposure on Sucarnoochee Creek at Livingston, Alabama.

DENTALINA COLEI Cushman and Dusenbury

Plate 79, figure 12

Dentalina colei CUSHMAN and DUSENBURY, *1934*, Cushman Lab. Foram. Research Contr., vol. 10, p. 54, pl. 7, figs. 10–12. (Middle Eocene, California.) PARR, *1937–38*, Roy. Soc. W. Australia, Jour. vol. 24, p. 76, pl. 1, fig. 8. (Upper Eocene, Australia.)

Test rather stout, arcuate; chambers gradually increasing in length and width from a broadly rounded aboral extremity, in the early portion of the test short, uninflated, and very slightly appressed, becoming longer in the mature portion of the test, the final chamber somewhat inflated; surface smooth; sutures distinct dark bands, flush with the surface in the early stages, slightly depressed between the two final chambers; aperture eccentric, radiate. Diameter up to 0.31 mm., length up to 1.66 mm.

Hypotype.—Princeton University no. 50795.

Locality.—Station 2.

Remarks.—This seems to be identical with the species described by Cushman and Dusenbury from theEocene Poway conglomerate of California. It is common in the Salt Mountain limestone and the Hatchetigbee formation of Alabama, and the Vincentown formation of New Jersey. It is very similar to the Midway form referred to *Vaginulina legumen* var. *elegans* d'Orbigny by Plummer and to *Dentalina*(?) *gardnerae* (Plummer) by Cushman. It is similar also to *Dentalina* sp. figured by Israelsky (1939, p. 576, pl. 3, figs. 12, 13) from the Eocene of California.

DENTALINA COMMUNIS (d'Orbigny)

Plate 79, figure 13

Nodosaria (*Dentalina*) *communis* D'ORBIGNY, *1826*, Soc. nat. sci. Ann., vol. 7, p. 254, no. 35.

Nodosaria communis CUSHMAN, *1923*, U. S. Nat. Mus. Bull. 104, pt. 4, p. 75, pl. 12, figs, 3, 4, 15–17. (Recent, Atlantic Ocean.)

Dentalina communis HOWE and WALLACE, *1932*, Louisiana Dept. Cons., Geol. Bull. No. 2, p. 24, pl. 6, fig. 8. (Upper Eocene, Louisiana.)

Test elongate, gently tapering, arcuate, initial end acuminate; chambers about 10 in number, later chambers slightly inflated; sutures distinct, inclined to the axis of the test, depressed between later chambers; aperture radiate, eccentric, protruding. Diameter up to 0.24 mm.; length up to 1.75 mm.

Hypotype.—Princeton University no. 50796.

Locality.—Station 2.

Remarks.—This is not a common species in this part of the Wilcox section. It was not recorded by Plummer from the Midway of Texas, and the specimens referred to *D. communis*(?) d'Orbigny by Cushman and Ponton from the upper Wilcox of Ozark, Alabama, and by Cushman and Garrett from Woods Bluff, Alabama, are somewhat different from this Salt Mountain limestone species.

DENTALINA CONFLUENS Reuss
Plate 79, figure 14

Dentalina confluens REUSS, *1861* (*1862*), Sitz, Akad. Wiss. Wien, vol. 44, pt. 1, p. 335, pl. 7, fig. 5. (Eocene?, New Jersey.) JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 176, pl. 29, fig. 5. (U. Cretaceous, New Jersey.)

Test slightly curved, gently tapering, with an initial spine; chambers about as long as broad, later ones inflated; sutures distinct and depressed between the later chambers, indistinct between the earlier chambers; surface ornamented with numerous fine, low, blunt, longitudinal costae, becoming more numerous on the later chambers, about 18 to 24 on the last chamber of adult specimens; aperture radiate, eccentric, produced. Diameter up to 0.6 mm.; length up to 4 mm. or more.

Hypotype.—Princeton University no. 50797.

Locality.—Station 2.

Remarks.—Several ribbed dentaline forms that are very difficult to separate occur in the Salt Mountain limestone. Those of the type figured, with about 18 to 24 rounded costae and an initial spine, are referred to this species of Reuss'. The species is common in the limestone. It is rare in the Midway group and in the Nanafalia formation. A similar form is common in the Vincentown limesand of New Jersey. Reuss' type came from the "senonischen Grünsandes" of New Jersey. Somewhat similar forms have been referred to *Nodosaria fissicostata* (Gümbel). Gümbel's original figure shows no initial spine, and the later chambers are more inflated than are those of the Salt Mountain species. *Marginulina cocoaensis* Cushman figured by Israelsky (1939, p. 574, pl. 3, figs. 8–10) from the Eocene of California appears to be this species.

DENTALINA GARDNERAE (Plummer)
Plate 79, figure 15

Marginulina gardnerae PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 106, pl. 5, figs. 11a–c. (Lower Midway, Texas.)

Test large, tapering, arcuate; chambers numerous, uninflated, broader than long throughout the test, very short in the early portion of the test, gradually increasing in length in the mature portion, chambers succeeding the small bluntly rounded proloculum rapidly increasing in size, of nearly uniform size in the mature portion of the test, final chambers of some specimens decreasing slightly in size; wall smooth, polished; sutures distinct, transverse, flush with the surface, slightly depressed between the last two chambers of some specimens; aperture eccentric, radiate. Diameter up to 0.6 mm.; length up to 5 mm.

Hypotype.—Princeton University no. 50798.

Locality.—Station 2.

Remarks.—This is the same species that Plummer described from the lower Midway of Texas. It is much larger than the Texas form and does not show any trace of coiling in the early portion. The Texas form was described as displaying a suggestion of coiling. It is a rather common species in the upper portion of the Salt Mountain limestone, and is frequent in the Wilcox marl bed at Station 3. This species is common in the Sucarnoochee clay at Livingston, Alabama.

DENTALINA JACKSONENSIS (Cushman and Applin)
Plate 79, figure 16

Nodosaria jacksonensis CUSHMAN and APPLIN, *1926*, Amer. Assoc. Petr. Geol. Bull., vol. 10, p. 170, pl. 7, figs. 14–16. (Upper Eocene, Texas.)
Dentalina jacksonensis CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr. vol. 8, p. 55, pl. 7, figs. 10, 11. (Wilcox group, Ozark, Alabama.)

Test arcuate, tapering, initial end rounded; chambers 8 to 10 in number, early chambers slightly inflated, later chambers greatly inflated, gradually increasing in length and width as added; wall smooth; sutures transverse, much constricted in the later portion of the test; aperture somewhat eccentric, radiate, protruding. Average diameter 0.18 mm.; average length 0.94 mm.

Hypotype.—Princeton University no. 50799.

Locality.—Station 2.

Remarks.—These Wilcox specimens are probably *D. jacksonensis*. They are referred to that species even though they lack an initial spine. The holotype of *N. jacksonensis* in Cushman's collection does not have a spine, and the two paratypes are broken and lack the initial chambers. The presence of one or more spines, however, is mentioned in the description as characteristic of the species. The Wilcox specimens are very similar to the holotype.

A somewhat similar form from the Upper Cretaceous of Texas has been referred to *Dentalina reussi* Neugeboren, but the original figure of that species shows longer and less inflated adult chambers than the Salt Mountain species possesses.

DENTALINA OBLIQUA (Linné)
Plate 79, figure 17

Nautilus obliquus LINNÉ, *1758*, Syst. Nat., ed. 10, p. 711; ed. 13 (Gmelin's), p. 3372.
Nodosaria (Dentalina) obliqua CHAPMAN and PARR, *1926*, Linn. Soc. Zoology Jour., vol. 36, p. 384, pl. 19, fig. 46. (Tertiary, Australia.)
Dentalina obliqua PLUMMER, *1931*, Univ. Texas Bull. 3101, p. 153, pl. 11, fig. 6. (U. Cretaceous, Texas.)
Nodosaria obliqua BERMUDEZ, *1938*, Soc. cubana hist. nat. Mem., vol. 12, no. 1, p. 16. (Eocene, Cuba.)

Test elongate, arcuate; chambers numerous, rather strongly inflated; surface ornamented with numerous low, rounded costae extending across the sutures obliquely to the axis of the test; sutures depressed; aperture radiate, protruding, eccentric. Diameter 0.58 mm.; length of fragment illustrated 3.31 mm.

Hypotype.—Princeton University no. 50800.

Locality.—Station 2.

Remarks.—This is a rare species in the limestone.

DENTALINA OBLIQUESUTURATA Stache
Plate 79, figure 18

Dentalina obliquesuturata STACHE, *1864*, *Novara*-Exped. Geol. Theil, Bd. 1, Abt. 2, p. 207, pl. 22, fig. 36. (Eocene, New Zealand.)
Dentalina obliquisuturata CUSHMAN and DUSENBURY) *1934*, Cushman Lab. Foram. Research Contr., vol. 10, p. 54, pl. 7, figs. 22–25. (Middle Eocene, California.)
Dentalina communis(?) CUSHMAN and PONTON [part], *1932*, Cushman Lab. Foarm. Research Contr., vol. 8, p. 55, pl. 7, fig. 12 [not fig. 13]. (Wilcox group, Ozark, Alabama.)

Test stout, slightly arcuate, initial end rather sharply rounded; chambers rapidly increasing in size in the early portion of the test, slightly inflated; wall smooth; sutures distinct, depressed, strongly oblique to the axis of the test; aperture radiate, eccentric. Diameter up to 0.28 mm.; length up to 1.42 mm.

Hypotype.—Princeton University no. 50801.

Locality.—Station 2.

Remarks.—The specimens compare closely with the figure of the type specimen of Stache. It is a frequent but not a common species in the limestone and is also present in the Hatchetigbee formation at Hatchetigbee Bluff.

DENTALINA cf. D. POMULIGERA Stache
Plate 79, figure 19

Nodosaria pomuligera PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 81, pl. 4, figs. 15, a, b, pl. 14, fig. 3. (Midway group, Texas.)
Dentalina sp. CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 58, pl. 10, figs. 20, 21. (Midway group, Alabama.)

Test elongate, slightly curved, tapering; chambers rapidly increasing in size in the early portion of the test, of nearly uniform size in the mature portion, becoming increasingly inflated toward the apertural end; wall smooth except for overlap of shell matter on the upper portion of chambers; sutures slightly if at all constricted in the early portion of the test, strongly depressed in the mature portion; aperture eccentric and protruding. Diameter up to 0.42 mm.; length 3 mm.

Depository.—Princeton University no. 50802.

Locality.—Station 2.

Remarks.—This is a rare species in this part of the Wilcox section. It is the same as

the form described by Plummer from the Midway of Texas where it was reported to be frequent but not common. It is present in Alabama in the Midway group and the Nanafalia formation, but not in the Bashi and Hatchetigbee formations.

DENTALINA SEMILAEVIS Hantken
Plate 79, figure 20

Dentalina semilaevis HANTKEN, *1875 (1876)*, Magyar. kir. földt. int. évkön., vol. 4, p. 32, pl. 4, fig. 6, pl. 12, fig. 13. (Tertiary, Central Europe.) NUTTALL, *1932*, Jour. Paleontology, vol. 6, p. 15, pl. 3, fig. 8. (Oligocene, Mexico.) PALMER and BERMUDEZ, *1936*, Soc. cubana hist. nat. Mem., vol. 10, no. 4, p. 261. (Late Tertiary, Cuba.) BERMUDEZ, *1938*, Soc. cubana hist. nat. Mem., vol. 12, no. 1, p. 3. (Eocene, Cuba.)

Small specimens of the type figured are rare in the Salt Mountain limestone and the Wilcox marl bed. They are ornamented with low logitudinal costae. The last one or two chambers are inflated and are without ornamentation. The aperture is eccentric, radiate and produced. The initial end is acuminate. Diameter up to 0.3 mm.; length up to 1.5 mm.

Hypotype.—Princeton University no. 50803.

Locality.—Station 2.

DENTALINA cf. D. FISSICOSTATA Gümbel
Plate 79, figures 21, 22

Specimens very similar to the Eocene species *D. fissicostata* are frequently found in the limestone. They are arcuate, the initial end is rounded and seems to lack an initial spine, and the adult chambers are rather strongly inflated. The specimens differ from the typical *D. fissicostata* in having finer, more numerous costae. The costae average about 40 in number on the adult chambers of the larger specimens. Diameter up to 0.7 mm.; length up to about 4 mm.

Depository.—Princeton University no. 50804

Locality.—Station 2.

DENTALINA SOLUTA Reuss
Plate 79, figures 23, 24

Dentalina soluta REUSS, *1851*, Deutsch. geol. Gesell. Zeitschr, vol. 3, p. 60, pl. 3, fig. 4. (Oligocene, Germany.) PLUMMER, *1931*, Univ. Texas Bull. 3101, p. 150, pl. 11, fig. 14. (U. Cretaceous, Texas.)

Nodosaria soluta PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 78, pl. 4, fig. 10. (Upper Midway, Texas.) BERMUDEZ, *1938*, Soc. cubana hist. nat. Mem., vol. 12, no. 1, p. 16. (Eocene, Cuba.)

Test straight to faintly curved, apical end with a small spine; chambers few, greatly inflated, increasing rapidly in size as added; sutures straight, deeply constricted; wall smooth; aperture terminal, somewhat eccentric, protruding, radiate. Diameter 0.26 mm.; length of fragment illustrated 0.83 mm.

Hypotype.—Princeton University no. 50805.

Locality.—Station 2.

Remarks.—Fragments of this widely distributed species are rare in this formation.

DENTALINA VERTEBRALIS (Batsch)
Plate 79, figure 25

Nautilus (Orthoceras) vertebralis BATSCH, *1791*, Conch. Seesandes, p. 3, no. 6, pl. 2, figs. 6a, b. (Recent, Mediterranean.)

Dentalina vertebralis SHERBON and CHAPMAN, *1886*, Roy. Micr. Soc. Journ., ser. 2, vol. 6, p. 752, pl. 14, figs. 39a, b. (Eocene, England.) CUSHMAN, *1931*, Cushman Lab. Foram. Research Contr., vol. 7, pl. 66, p. 8, figs. 20, 21. (Recent, Mediterranean.)

Nodosaria vertebralis PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 88, pl. 5, fig. 10. (Midway group, Texas.) NUTTALL, *1930*, Jour. Paleontology, vol. 4, p. 283. (Aragón formation, Mexico.) BERMUDEZ, *1938*, Soc. cubana hist. nat. Mem., vol. 12, no. 1, p. 17. (Eocene, Cuba.)

Test elongate, initial end with a small spine; chambers distinct, uninflated except the final one or two chambers; sutures distinct, of clear shell material, flush with the surface except between the last two or three chambers where they may be slightly depressed; surface ornamented with 8 to 12 prominent longitudinal costae, continuous across the chambers from the initial to the apertural end, except on the final chamber of some specimens which is smooth; aperture radiate, slightly eccentric. Average diameter 0.57 mm.; average length 3.3 mm.

Hypotype.—Princeton University no. 50806.

Locality.—Station 3.

Remarks.—This species is similar to *Nodosaria latejugata* Gümbel, but the specimens in this formation referred to *D. vertebralis* differ in having arcuate tests, uninflated chambers, and sutures that are flush with the surface throughout nearly all the test.

The specimens are very close to figures of topotypes from Rimini. *Nodosaria* sp. B figured by Israelsky (1939, p. 575, pl. 5, fig. 5) from the Eocene of California is probably this species.

Genus NODOSARIA Lamarck, 1812
NODOSARIA LATEJUGATA Gümbel
Plate 79, figures 26, 27

Nodosaria latejugata GÜMBEL, *1868 (1870)*, K. bayer. Akad. Wiss. München, Cl. 2, Abh., vol. 10, p. 619, pl. 1, fig. 32. (Upper Eocene, Bavaria.) CUSHMAN, *1935*, U. S. Geol. Survey, Prof. Paper 181, p. 21. (See this reference for further synonymy.) (Upper Eocene, U. S. Coastal Plain.) CUSHMAN and MCMASTERS, *1936*. Jour. Paleontology, vol. 10, p. 512, pl. 75, figs. 11, 12. (Middle Eocene, California.)
Nodosaria affinis PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 89, pl. 14, figs. 2a–d. (Midway group, Texas.) CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 59, pl. 10, figs. 30–33. (Midway group, Alabama.)

Test large, elongate, initial end with a stout spine; chambers distinct, about as long as broad, slightly inflated; sutures distinct, of clear shell material, slightly depressed, especially between the later chambers; surface ornamented with 10 or 12 prominent longitudinal costae, continuous across the sutures from the initial to the apertural end; apertural end produced, aperture radiate. Dimensions of average specimen: diameter 0.83 mm.; length 4.14 mm.

Hypotypes.—Princeton University nos. 50807, 50808.

Locality.—Stations 2, 3.

Remarks.—This is the same species as the Midway form described by Plummer under the name *Nodosaria affinis* d'Orbigny. Identical forms occur in the Midway group in Alabama, and in the Nanafalia, Tuscahoma, and Hatchetigbee formations. A smaller, more slender variety occurs in the upper Wilcox at Ozark, Alabama, and at other localities in the Bashi formation. The name *Nodosaria affinis* d'Orbigny, 1846, is preoccupied by *N. affinis* Reuss, 1845. It is therefore necessary to assign a new name to this form which is very common and widely distributed in the lower Eocene of the Gulf Coast. It seems to be the same as *N. latejugata* Gümbel. Specimens compare closely with topotypes of *N. latejugata*. They are the same size, the tests of both are straight and the chambers are similarly inflated. Topotypes of *Nodosaria latejugata* have 12 to 14 ribs. The Eocene species is similar to the Cretaceous species *N. zippei* Reuss. It is different from the Cretaceous species *N. affinis* Reuss which has only four or five costae.

Nodosaria sp. figured by Israelsky (1939 p. 575, pl. 3, fig. 11) from the Eocene of California is probably this species.

NODOSARIA LATEJUGATA Gümbel var.
CAROLINENSIS Cushman
Plate 79, figure 28

Nodosaria latejugata var. *carolinensis* CUSHMAN, *1933*, Cushman Lab. Foram. Research Contr., vol. 9, p. 5, pl. 1, fig. 16. (Upper Eocene, South Carolina.); ——, *1935*, U. S. Geol. Survey, Prof. Paper, 181, p. 21, pl. 5, figs. 10–13. (Upper Eocene, U. S. Coastal Plain.) JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 177, pl. 29, fig. 10. (Hornerstown formation, New Jersey.)

Several specimens of this variety were recovered from the Salt Mountain limestone and the Wilcox marl bed. They are considerably larger than the specimens referred to *N. latejugata*, the chambers are more inflated, and the costae are more numerous and more rounded. These large specimens have 14 to 18 costae. They are similar to the holotype of *N. latejugata* var. *carolinensis* in Cushman's collection except that they are much larger. This species occurs in the Nanafalia formation of Alabama and in the Hornerstown and Vincentown formations of New Jersey. Dimensions of illustrated specimen: diameter 1.14 mm.; length of fragment 6.0 mm.

Hypotype.—Princeton University no. 50809.

Locality.—Station 2.

NODOSARIA PAUPERCULA Reuss
Plate 79, figures 29, 30

Nodosaria paupercula REUSS, *1845–46*, Verstein. Böhm. Kreide, pt. 1, p. 26, pl. 12, fig. 12. (U. Cretaceous, Central Europe.) CHAPMAN, *1926*, New Zealand Geol. Survey Paleont. Bull. no. 11, p. 51, pl. 3, figs. 25a–f. (U. Cretaceous, New Zealand.) FRANKE, *1928*, Preuss. Geol. Landesanstalt Abh., new ser., vol. 3, p. 45, pl. 3, fig. 37. (U. Cretaceous, Germany.)

Test rather small, delicate, straight, with a very small initial spine; chambers numerous, about 8 to 11 in average specimens, later chambers inflated, separated by deep con-

strictions, early chambers broader than long, last one or two chambers as long as broad, bulbous, proloculum generally as large as the adjacent chamber, succeeding chambers gradually increasing in size; sutures distinct, greatly depressed, in some specimens greatly depressed between the later chambers only; surface ornamented with 12 to 16 fine longitudinal costae extending from the initial to the apertural end: aperture terminal, produced, at the end of a small cylindrical neck. Diameter up to 0.22 mm.; length up to 1 mm. or more.

Hypotypes.—Princeton University nos. 50810, 50811.

Locality.—Stations 3, 2.

Remarks.—This species is frequent in portions of the limestone and also has been observed in samples collected from an outcrop of the Bashi formation on the Camden-Monroeville road 20.2 miles south of Camden.

Genus CHRYSALOGONIUM Schubert, 1907

CHRYSALOGONIUM GRANTI (Plummer)

Plate 79, figures 34, 35

Nodosaria filiformis CARSEY, *1926*, Univ. Texas Bull. 2612, p. 33, pl. 7, fig. 8. (U. Cretaceous, Texas.)

Nodosaria granti PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 83, pl. 5, figs. 9a–d. (Midway group, Texas.)

Dentalina granti PLUMMER, *1931*, Univ. Texas Bull. 3101, p. 149, pl. 11, figs. 8, 9. (U. Cretaceous, Texas.) JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 176, pl. 29, fig. 6. (U. Cretaceous, New Jersey.)

Ellipsonodosaria(?) granti CUSHMAN, *1936*, Cushman Lab. Foram. Research Contr., vol. 12, p. 51, pl. 9, figs. 3–5. (U. Cretaceous, Texas, Arkansas.)

Ellipsonodosaria granti CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 69, pl. 12, fig. 3. (Midway group, Alabama.)

Test elongate, very slender, gently tapering, slightly arcuate, with an initial spine; chambers numerous, elongate, about twice as long as broad, cylindrical to slightly inflated; wall smooth; sutures usually flush with the surface between early chambers, becoming slightly depressed between later chambers; aperture slightly protruding, composed of numerous very fine pores. Diameter 0.18 mm.; length of fragment 1.7 mm.

Hypotype.—Princeton University no. 50815.

Locality.—Station 2.

Remarks.—A few fragments only of this species were found.

CHRYSALOGONIUM TENUICOSTATUM Cushman and Bermudez

Plate 79, figure 33

Cyrysalogonium tenuicostatum CUSHMAN and BERMUDEZ, *1936*, Cushman Lab. Foram. Research Contr., vol. 12, p. 27, pl. 5, figs. 3–5. (Eocene, Cuba.)

Test elongate, slender, very gently tapering, slightly arcuate; chambers numerous, cylindrical to slightly inflated, longer than broad, increasing gradually in length as added, in the mature portion of the test more than twice as long as broad, proloculum bluntly rounded, almost globular; sutures distinct, slightly limbate, somewhat depressed; wall smooth on small specimens, on larger specimens faintly striate longitudinally; aperture terminal, consisting of numerous very fine pores. Diameter up to 0.22 mm.; length of longest fragment 2.1 mm.

Hypotype.—Princeton University no. 50814.

Locality.—Station 2.

Remarks.—The Salt Mountain form is smaller than the Cuban species to which it is referred, according to the dimensions given in the description, but it seems to come within the range of variation shown in the original figures of *C. tenuicostatum*. It is frequent at Station 2 and Station 3.

Genus PSEUDOGLANDULINA Cushman, 1929

PSEUDOGLANDULINA COMATA (Batsch)

Plate 79, figure 31

Nautilus (Orthoceras) comatus BATSCH, *1791*, Conch. Seesandes, pl. 1, fig. 2. (Recent, Mediterranean.)

Nodosaria (Glandulina) comata PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 76, pl. 4, fig. 7. (Lower Midway, Texas.)

Test ovate in outline; chambers few, greatly overlapping; sutures transverse, very slightly if at all depressed; surface faintly striate longitudinally; aperture terminal, radiate. Length 0.4 mm.

Hypotype.—Princeton University no. 50813.

Locality.—Station 3.

Remarks.—*P. comata* is a very rare species

in this part of the Wilcox section. A similar form occurs in the Midway of Alabama and Texas. It is figured under the name *Pseudoglandulina pygmaea* (Reuss) by Cushman (1940, p. 60).

PSEUDOGLANDULINA MANIFESTA? (Reuss)
Plate 79, figure 32

Test short, subovate in outline; chambers few, overlapping; sutures transverse, not depressed in the few specimens observed;

EXPLANATION OF PLATE 80

All specimens are from the Salt Mountain limestone of Wilcox Eocene age, Clarke County, Alabama, unless otherwise indicated.

FIGS. *1–3—Palmula mcglameryae* Toulmin, n. sp. *1*, Paratype, Princeton Univ. 50820, from Station 2. ×15. *2*, Alabama Mus. Nat. Hist., paratype 9, from station 2. ×15. *3*, Holotype, Princeton Univ. 50819, from Station 2. ×15. (p. 592)

4—Frondicularia archiaciana d'Orbigny. Hypotype, Princeton Univ. 50821, from Station 2. ×25. (p. 592)

5—Frondicularia frankei Cushman. Hypotype, Princeton Univ. 50822, from Station 2. ×17. (p. 592)

6—Lagena acuticosta Reuss. Hypotype, Princeton Univ. 50823, from Station 2. ×85. (p. 593)

7—Lagena laevis (Montagu). Hypotype, Princeton Univ. 50824, from Station 2. ×45. (p. 593)

8—Guttulina problema d'Orbigny, Hypotype, Princeton Univ. 50825, from Station 2. ×27. (p. 594)

9—Globulina gibba d'Orbigny. Hypotype, Princeton Univ. 50826, from Station 2. ×27. (p. 594)

10—Pyrulina cylindroides (Roemer). Hypotype, Princeton Univ. 50827, from Station 2. ×27. (p. 594)

11—Glandulina abbreviata Neugeboren. Hypotype, Princeton Univ. 50828, from Station 2. ×57. (p. 594)

12, 13—Glandulina laevigata d'Orbigny var. *occidentalis* Cushman. *12*, Megalospheric specimen, hypotype, Princeton Univ. 50829, from Station 2. ×27. *13*, Microspheric specimen, hypotype, Princeton Univ. 50830, from Station 2. ×27. (p. 595)

14—Pseudopolymorphina decora (Reuss). Hypotype, Princeton Univ. 50831, from Station 2. ×15. (p. 595)

15—Sigmomorphina cf. *S. wilcoxensis* Cushman and Ponton. Princeton Univ. 50832, from Station 2. ×27. (p. 595)

16—Polymorphina subrhombica Reuss. Hypotype, Princeton Univ. 50833, from Station 2. ×17. (p. 595)

17, 18—Polymorphinella elongata Toulmin, n. sp. Opposite sides of holotype, Princeton Univ. 50834, from Station 2. ×27. (p. 596)

19, 20—Polymorphinella subcompressa Toulmin, n. sp. Opposite sides of holotype, Princeton Univ. 50835, from Station 2. ×27. (p. 596)

21—Ramulina globulifera H. B. Brady. Hypotype, Princeton Univ. 50836, from Station 2. ×22. (p. 596)

22—Nonionella insecta (Schwager). Hypotype, Princeton Univ. 50837, from Station 2. ×82. (p. 597)

23—Nonionella turgida (Williamson). Hypotype, Princeton Univ. 50838, from Station 2. ×82. (p. 597)

24—Gümbelina wilcoxensis Cushman and Ponton. Hypotype, Princeton Univ. 50839, from Station 2. ×70. (p. 597)

25, 26—Bulimina ovata d'Orbigny. *25*, Hypotype, Princeton Univ. 50841, from Wilcox marl bed, Station 3. ×35. *26*, Hypotype, Princeton Univ. 52294, from Wilcox marl bed, Station 3. ×32. (p. 597)

27—Bulimina cf. *B. prolixa* Cushman and Parker. Princeton Univ. 52295, from Station 1. ×50. (p. 598)

28—Loxostoma sp. Princeton Univ. 52296, from Station 2. ×67. (p. 598)

29—Bifarina sp. Princeton Univ. 52297, from Station 2. ×60. (p. 599)

30—Angulogerina wilcoxensis (Cushman and Ponton). Hypotype, Princeton Univ. 50840, from Station 2. ×80. (p. 599)

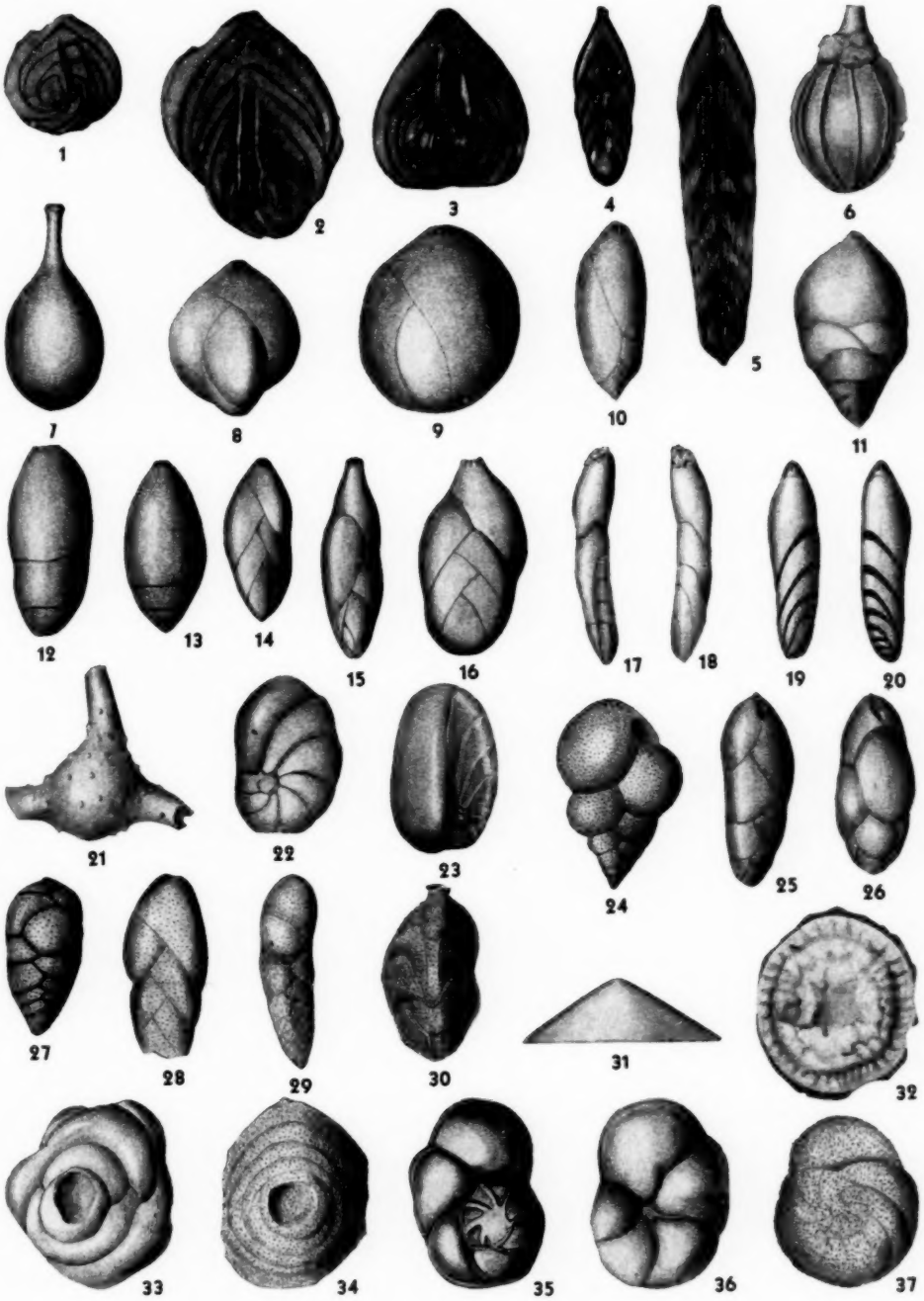
31, 32—Patellina sp. Princeton Univ. 52298, from Station 2. ×30. *31*, Side view. *32*, Ventral view. (p. 599)

33—Patellinoides? sp. Dorsal view, Princeton Univ. 52299, from Station 4j. ×25. (p. 599)

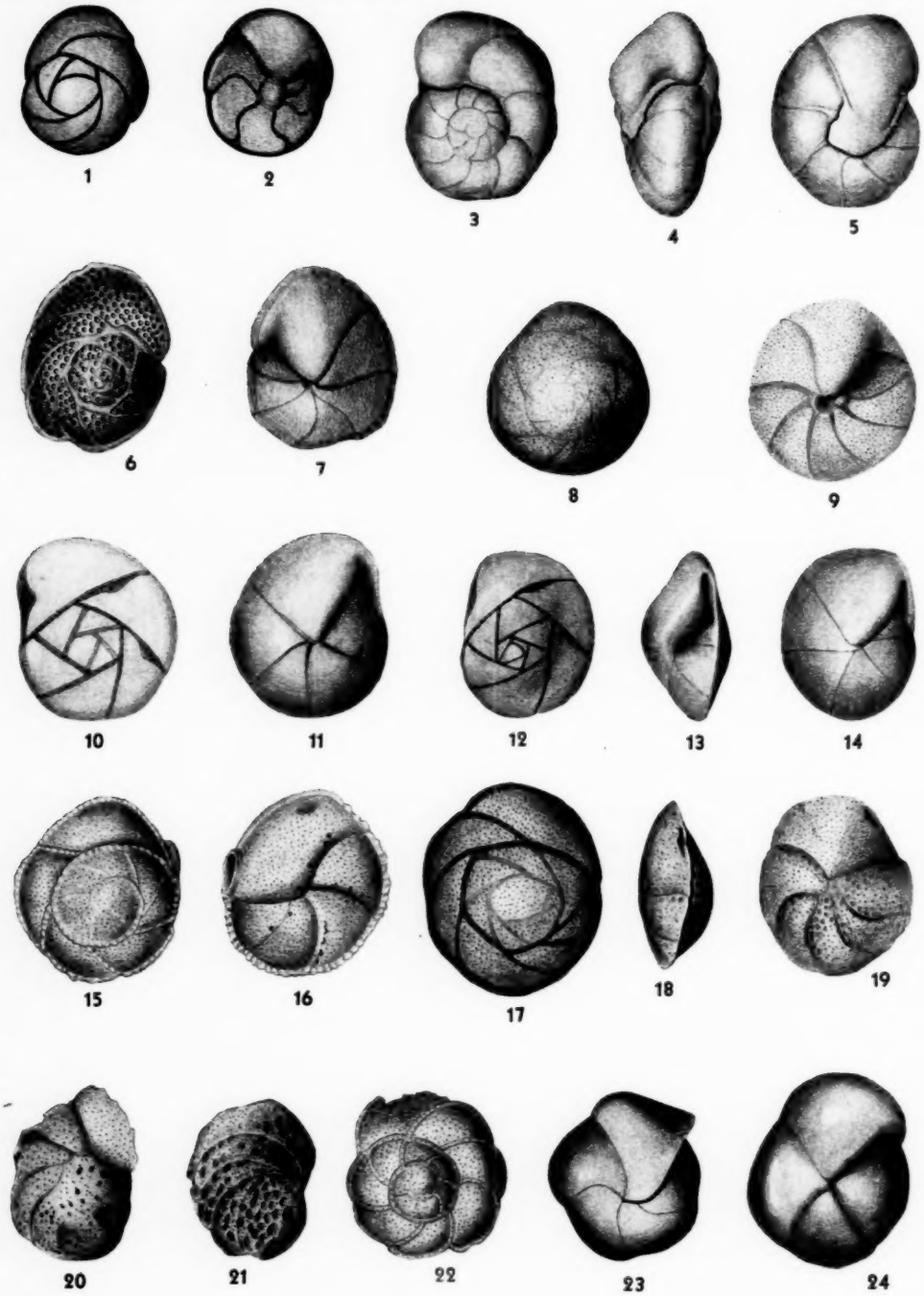
34—Patellinella? sp. Dorsal view, Princeton Univ. 52300, from Station 1. ×25. (p. 600)

35, 36—Discorbis rukasi Howe. Hypotype, Princeton Univ. 52301, from Station 1. ×17. *35*, Dorsal view. *36*, Ventral view (p. 600)

37—Discorbis sp. *A*. Princeton Univ. 52302, from Station 2. ×45. (p. 600)



Toulmin, Eocene Foraminifera



Toulmin, Eocene Foraminifera

wall smooth; aperture protruding, radiate. Length of illustrated specimen 0.4 mm.

Depository.—Princeton University no. 50812.

Locality.—Station 3.

Remarks.—This species is very rare in this part of the Wilcox section, and the specimens found are apparently not fully developed. A similar but more elongate form with more chambers is present in the Sucarnoochee clay at Livingston, Alabama. Cushman (1940, p. 60) figured this Alabama Midway form under the name *Pseudoglandulina manifesta* (Reuss). The Texas upper Midway form was referred to *Nodosaria radicula* (Linnaeus) by Plummer (1927, p. 77).

Genus LINGULINA d'Orbigny, 1826

LINGULINA WILCOXENSIS Cushman and Ponton

Plate 79, figures 37, 38

Lingulina wilcoxensis CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 58, pl. 7, figs. 14a, b. (Wilcox group, Ozark, Alabama.)

Test large, elongate, somewhat compressed, periphery bluntly angled, greatest thickness in the middle, sides nearly parallel in the adult portion, tapering rapidly at the base, apertural end broadly rounded; chambers distinct, the earliest ones showing traces of coiling, later ones in a rectilinear series, slightly overlapping; sutures distinct, slightly depressed in the adult portion of the test, the central portion of the sutures curving back slightly toward the base of the test, the peripheral ends of the sutures oblique and curving back toward the base; wall smooth; aperture a very elongate slit-like opening, terminal. Length up to 3.96 mm.; width up to 1.53 mm.; thickness up to 0.83 mm.

Hypotypes.—Princeton University nos. 50816, 50817.

Locality.—Station 2.

Remarks.—*Lingulina wilcoxensis* is one of the most common and conspicuous species in the Salt Mountain limestone. It ranges throughout the formation. It is strange that no specimens were observed in the Wilcox marl bed at Station 3, which carries several of the Ozark (upper Wilcox) species

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EXPLANATION OF PLATE 81

All specimens are from the Salt Mountain limestone of Wilcox Eocene age, Clarke County, Alabama, unless otherwise indicated.

FIGS. *1, 2—Discorbis* sp. *B*. Princeton Univ. 52303, from Station 2. ×80. *1*, Dorsal view. *2*, Ventral view. (p. 600)

3–5—Gyroidina soldanii d'Orbigny var. *octocamerata* Cushman and G. D. Hanna. Hypotype, Princeton Univ. 52304, from Station 2. ×62. *3*, Dorsal view. *4*, Peripheral view. *5*, Ventral view. (p. 600)

6, 7—Eponides boueana (d'Orbigny). Hypotype, Princeton Univ. 52305, from Station 2. ×82. *6*, Dorsal view. *7*, Ventral view. (p. 601)

8, 9—Eponides dorfi Toulmin, n. sp. Holotype, Princeton Univ. 52306, from Station 2. ×55. *8*, Dorsal view, *9*, Ventral view. (p. 601)

10, 11—Alabamina wilcoxensis Toulmin, n. sp. Paratype, Princeton Univ. 52307, from Stations 2. ×60. *10*, Dorsal view. *11*, Ventral view. (p. 603)

12–14—Alabamina wilcoxensis Toulmin, n. sp. Holotype, Princeton Univ. 52308, from upper Wilcox in railroad cut one mile north of Ozark, Alabama. ×60. *12*, Dorsal view, *13*, Peripheral view. *14*, Ventral view. (p. 603)

15, 16—Siphonina wilcoxensis Cushman. Hypotype, Princeton Univ. 52310, from Wilcox marl bed, Station 3. ×80. *15*, Dorsal view. *16*, Ventral view. (p. 605)

17–20—Coleites laevigatus Toulmin, n. sp. *17*, Dorsal view of paratype, Princeton Univ. 52311, from Station 2. ×50. *18*, Peripheral view of holotype, Princeton Univ. 52312, from Station 2. ×35. *19*, Ventral view of holotype. *20*, Ventral view of paratype, Princeton Univ. 52313, from Station 2. ×25. (p. 605)

21—Coleites reticulosus (Plummer). Dorsal view of hypotype, Princeton Univ. 52314, from Station 2. ×32. (p. 606)

22—Asterigerina cf. *A. primaria* Plummer. Dorsal view, Princeton Univ. 52315, from Station 2. ×75. (p. 606)

23—Pullenia eocenica Cushman and Siegfus. Hypotype, Princeton Univ. 52316, from Station 2. ×35. (p. 606)

24—Pullenia quinqueloba (Reuss). Hypotype, Princeton Univ. 52317, from Station 2. ×75. (p. 607)

that are not present in the Salt Mountain limestone.

Genus VAGINULINA d'Orbigny, 1826
VAGINULINA sp.
Plate 79, figure 36

A peculiar *Vaginulina*, with a curved axis, was found in the limestone. The test is much compressed, the periphery narrowly rounded, the sutures curved and very oblique, and the aperture produced, at the end of a cylindrical neck. This form is very rare. Length 1.33 mm.; width 0.33 mm.; thickness 0.22 mm.

Depository.—Princeton University no. 50818.

Locality.—Station 2.

Genus PALMULA Lea, 1833
PALMULA MCGLAMERYAE Toulmin, n. sp.
Plate 80, figures 1–3

Test large, broad to elongate, much compressed, thickest through the proloculum, base variable in outline, rounded to straight, periphery broadly rounded except at the base of the test, sharply angled to carinate at the base; chambers uninflated, early chambers coiled, later chambers bilaterally symmetrical, narrow, chevron-shaped; sutures distinct, limbate, flush with the surface, of clear shell material; wall ornamented with a few bluntly rounded ridges on the coiled portion, ridges most prominent on broad specimens with straight base, generally absent on elongate specimens with rounded base; aperture terminal, produced. Length up to 3.4 mm.; width up to 2.2 mm.

Holotype.—Princeton University no. 50819.

Paratypes.—Princeton University no. 50820, Alabama Museum of Natural History, paratype 9.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—There is considerable variation in the outline and in the amount of ornamentation of different individuals. Specimens having a base narrowly rounded in outline are without ornamentation. In the collection a suite of specimens shows all gradations from the elongate smooth form with narrowly rounded base to the broad, highly ornamented form with a straight base. This species resembles *Frondicularia philippinensis* Cushman in its range of variations, but it differs from that species in many details. It resembles *Palmula pilulata* Cushman of the Upper Cretaceous, but *P. mcglameryae* is ornamented with ridges instead of beads, and the sutures are not raised. The Cretaceous species is thicker. *P. mcglameryae* has been observed at several localities in the limestone, and at Station 3. It has been observed also in the *Ostrea thirsae* marl of the Nanafalia formation in an outcrop on the Camden-Monroeville road 7.4 miles south of Camden.

Genus FRONDICULARIA Defrance, 1826
FRONDICULARIA ARCHIACIANA d'Orbigny
Plate 80, figure 4

Frondicularia archiaciana D'ORBIGNY, *1840*, Soc. géol. France, Mém ser. 1, vol. 4, p. 20, pl. 1, figs. 34–36. (U. Cretaceous, France.) CUSHMAN, *1936*, Cushman Lab. Foram. Research Contr., vol. 12, p. 19, pl. 4, figs. 8–10. (U. Cretaceous, U. S. Coastal Plain.) (For further synonymy see this last reference.)

Test elongate, slender, widest at the base of the final chamber, much compressed, with a small inflated smooth proloculum, periphery truncate, flat; chambers numerous, chevron-shaped, increasing gradually in size as added; sutures distinct, strongly oblique to the periphery; wall smooth; aperture small, terminal, protruding, at the end of a slender neck. Length up to 1.4 mm.; width up to 0.42 mm.; thickness 0.09–0.17 mm.

Hypotype.—Princeton University no. 50821.

Locality.—Station 2.

Remarks.—This species is common in portions of the limestone and in the Wilcox marl at Station 3.

FRONDICULARIA FRANKEI Cushman
Plate 80, figure 5

Frondicularia archiaciana var. *strigillata* BAGG, *1898*, [not *F. strigillata* REUSS, 1860], U. S. Geol. Survey Bull. 88, p. 47, pl. 3, fig. 5. (Vincentown formation, New Jersey.) WELLER, *1907*, New Jersey Geol. Survey, Paleontology, vol. 4, p. 226, pl. 2, fig. 22. (Vincentown formation, New Jersey.) PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 114, pl. 5, figs. 2a, b. (Upper Midway, Texas.)

Frondicularia frankei CUSHMAN, *1936*, Cushman Lab. Foram. Research Contr., vol. 12, p. 18,

pl. 4, figs. 6, 7. (U. Cretaceous, U. S. Coastal Plain.)

Frondicularia cf. *frankei* CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16 p. 63, pl. 10, figs. 36–37. (Midway group, Alabama.)

Test elongate, lanceolate, widest at the base of the final chamber, compressed, with a rather large inflated proculum and stout initial spine, periphery truncate, flat; chambers up to about 8 or 10 in number in large specimens, chevron-shaped, gradually increasing in size as added; sutures indistinct, obscured by the ornamentation of the test, limbate, especially near the median line of the test; wall marked by fine longitudinal, discontinuous raised costae, proloculum ornamented by one to three longitudinal raised costae; aperture terminal, protruding. Length up to 3.04 mm.; width up to 0.74 mm.; thickness up to 0.28 mm.

Hypotype.—Princeton University no. 50822.

Locality.—Station 2.

Remarks.—This form was originally described by Bagg as a variety of *F. archiaciana*. Bagg's specimens came from the Vincentown limesand of New Jersey. *F. frankei* has been reported from the upper Midway of Texas and Alabama by Plummer.

Genus LAGENA Walker and Jacob, 1798

LAGENA ACUTICOSTA Reuss

Plate 80, figure 6

Lagena aculicosta REUSS, *1861 (1862)*, Sitz. Akad. Wiss. Wien, vol. 44, pt. 1, p. 305, pl. 1, fig. 4. CUSHMAN, *1913*, U. S. Nat. Mus. Bull. 71, pt. 3, p. 23, pl. 8, figs. 9, 10, pl. 23, fig. 2. (Recent, Pacific Ocean.) CUSHMAN, *1923*, U. S. Nat. Mus. Bull. 104, pt. 4, p. 5, pl. 1, figs. 1–3. (Recent, Atlantic Ocean.) CUSHMAN, *1931*, Jour. Paleontology, vol. 5, p. 308, pl. 35, fig. 12. (U. Cretaceous, Arkansas.) CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 59, pl. 7, figs. 20a, b. (Wilcox group, Ozark, Alabama.) CUSHMAN, *1932*, Jour. Paleontology, vol. 6, p. 337, pl. 50, fig. 13, (U. Cretaceous, Texas, Arkansas.) CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 80, pl. 14, fig. 6. (Wilcox group, Woods Bluff, Alabama.)

Test small, nearly globular, tapering at the apertural end, circular in transverse section; wall ornamented with about 12 distinct longitudinal costae extending from the ring surrounding the aperture to the base of the test; aperture slightly protruding. Length up to 0.3 mm.; diameter up to 0.2 mm.

Hypotype.—Princeton University no. 50823.

Locality.—Station 2.

Remarks.—This small form is identical with that described by Cushman and Ponton from the Wilcox of Ozark, Alabama, and referred to this species of Reuss. It is also present in the Bashi and Hatchetigbee formations. It is not common in the Salt Mountain limestone. The costae seem to be somewhat less rounded than in Reuss' illustration.

LAGENA LAEVIS (Montagu)

Plate 80, figure 7

"Serpula (Lagena) laevis ovalis" WALKER and BOYS, *1784*, Test. Min., p. 3, pl. 1, fig. 9.

Vermiculum laeve MONTAGU, *1803*, Test. Brit., p. 524.

Lagena laevis CUSHMAN, *1913*, U. S. Nat. Mus. Bull. 71, pt. 3, p. 5, pl. 1, fig. 3; pl. 38, fig. 5. (Recent, Pacific Ocean.) HOWE, *1939*, Louisiana Dept. Cons., Geol. Bull. No. 14, p. 50, pl. 6, fig. 12. (Claiborne group, Louisiana.)

Lagena clavata CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 60, pl. 7, figs. 23a, b. (Wilcox group, Ozark, Alabama.)

Test globular to ellipsoid, circular in transverse section, with long slender neck and phialine lip; wall without ornamentation; aperture a round opening at the end of the long neck. Length (including neck) up to 0.6 mm.; diameter up to 0.35 mm.

Hypotype.—Princeton University no. 50824.

Locality.—Station 2.

Remarks.—The form figured is common in the limestone. The shape of the body is somewhat variable, as is the relative length of the neck and the degree of development of the phialine lip. The specimens seem to be the same as the upper Wilcox form from Ozark, Alabama, referred to *Lagena clavata* (d'Orbigny). A considerable proportion of the Ozark specimens have a somewhat more narrowly rounded base. D'Orbigny's original figure of *L. clavata* shows a form with a distinctly pointed base. *L. laevis* is rare in the Nanafalia formation at Nanafalia Landing and in the Hatchetigbee formation at Hatchetigbee Bluff.

Family POLYMORPHINIDAE
Genus GUTTULINA d'Orbigny, 1839
GUTTULINA PROBLEMA d'Orbigny
Plate 80, figure 8

Guttulina problema D'ORBIGNY, *1826*, Ann. Sci. Nat., vol. 7, p. 266, no. 14. (Pliocene, Italy.) CUSHMAN and OZAWA, *1930*, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 19, pl. 2, figs. 1–6; pl. 3, figs. 1a–c. (Cretaceous to Recent.) (See this reference for further synonymy.) CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 61, pl. 8, figs. 3, 4. (Wilcox group, Ozark, Alabama.)

Test subovate, broadly rounded at the initial end, acute at the apertural end; chambers elongate, inflated, each succeeding chamber slightly removed from the base; sutures distinct, depressed; wall smooth; aperture radiate. Length up to 1 mm.; width up to 0.68 mm.

Hypotype.—Princeton University no. 50825.

Locality.—Station 2.

Remarks.—This widely distributed species is very common in the limestone. It is present throughout the Wilcox group in Alabama. Plummer (1927, p. 123) records this species from the Kincaid formation (lower Midway) of Texas under the name *Polymorphina communis* d'Orbigny. Cushman (1940, p. 63) records an Alabama Midway specimen under the name *Guttulina* sp. It may be this species, which is frequent in the Midway of Alabama.

Genus GLOBULINA d'Orbigny, 1839
GLOBULINA GIBBA d'Orbigny
Plate 80, figure 9

Globulina gibba D'ORBIGNY, *1826*, Ann. Sci. Nat., vol. 7, p. 266, No. 10; Mod les No. 63. (Pliocene, Italy.); ——, *1846*, Foram. Foss. Bass. Tert. Vienne, p. 227, pl. 13, figs. 13, 14. (Miocene, Austria.) CUSHMAN and OZAWA, *1930*, Proc. U. S. Nat. Mus., vol. 77, art. 6, p. 60, pl. 16, figs. 1–4. (Eocene to Recent.) (See this reference for further synonymy.) HOWE, *1939*, Louisiana Dept. Cons., Geol. Bull. No. 14, p. 53, pl. 6, figs. 25, 26. (Claiborne group, Louisiana.)

Polymorphina gibba. PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 122, pl. 6, figs. 8a, b. (Midway group, Texas.)

Test globular to subglobular, circular in transverse section; chambers few, rounded; sutures marked by dark lines, often indistinct, not depressed; wall smooth, or with a fistulose growth near the apertural end of some specimens; aperture radiate. Diameter up to 0.83 mm.

Hypotype.—Princeton University no. 50826.

Locality.—Station 2.

Remarks.—This species is very common in the limestone. It has been observed in the Nanafalia, Tuscahoma, and Hatchetigbee formations. Cushman (1940, p. 63) records this species from the Midway group of Alabama.

Genus PYRULINA d'Orbigny, 1839
PYRULINA CYLINDROIDES (Roemer)
Plate 80, figure 10

Polymorphina cylindroides ROEMER, *1838*, Neues Jahrb. p. 385, pl. 3, fig. 26. (Oligocene, Germany.)

Pyrulina cylindroides CUSHMAN and OZAWA, *1930*, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 56, pl. 14, figs. 1–5. (Cretaceous to Recent.) (See this reference for further synonymy.)

Test elongate, subcylindrical, acuminate at both ends, almost circular in transverse section; chambers elongate, each succeeding chamber farther removed from the base; sutures not depressed; wall smooth, polished; aperture radiate. Length up to 0.88 mm., diameter up to 0.33 mm.

Hypotype.—Princeton University no. 50827.

Locality.—Station 2.

Remarks.—Specimens resembling *Pyrulina cylindroides* are rare in the Salt Mountain limestone.

Genus GLANDULINA d'Orbigny, 1826
GLANDULINA ABBREVIATA Neugeboren
Plate 80, figure 11

Glandulina abbreviata NEUGEBOREN, *1850*, siebenbürg. Ver. Naturwiss. Verh. u. Mitt. Jahrb. 1, p. 48, pl. 1, figs. 1a, b. CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 64, pl. 8, figs. 9a, b. (Wilcox group, Ozark, Alabama.) CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 81, pl. 14, fig. 10. (Wilcox group, Woods Bluff, Alabama.)

Test short, broad; chambers biserially arranged in the early portion of the test, uniserial in the later portion, increasing rapidly in size as added, inflated; sutures distinct, depressed; wall smooth; aperture terminal. Length 0.45 mm., diameter 0.3 mm.

Hypotype.—Princeton University no. 50828.

Locality.—Station 2.

Remarks.—This species has been recorded from the upper Wilcox at Ozark and Woods Bluff, Alabama. It is rare in the Salt Mountain limestone.

GLANDULINA LAEVIGATA d'Orbigny
var. OCCIDENTALIS Cushman
Plate 80, figures 12, 13

Nodosaria (*Glandulina*) *laevigata* d'Orbigny var. *occidentalis* CUSHMAN, *1923*, U. S. Nat. Mus. Bull. 104, pt. 4, p. 64, pl. 12, fig. 8. (Recent, Atlantic Ocean.) PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 75, pl. 4, fig. 8. (Upper Midway, Texas.)

Test subovate, circular in section, tapering toward the aboral and apertural ends, base broadly rounded in the megalospheric form, pointed in the microspheric form; chambers few, greatly embracing, arranged biserially in the earliest portion of the test in the microspheric form; wall smooth; sutures indistinct, flush with the surface, transverse in the mature portion of the test; aperture large, round, radiate. Length up to 1.05 mm.; diameter up to 0.42 mm.

Hypotypes.—Princeton University nos. 50829, 50830.

Locality.—Station 2.

Remarks.—A study of the early stage of the microspheric form shows the chambers to be biserially arranged, and the genus is therefore a true *Glandulina*. Recent specimens in Cushman's collection have a similar arrangement of chambers. This is a common species in the Salt Mountain limestone, but it was not observed in the Wilcox marl bed at Station 3. It is reported to be present in the upper Midway in Texas. It is common in the Hatchetigbee formation at Stabler's Bluff, Alabama.

Genus PSEUDOPOLYMORPHINA Cushman
and Ozawa, 1928
PSEUDOPOLYMORPHINA DECORA (Reuss)
Plate 80, figure 14

Polymorphina decora REUSS, *1863*, Acad. roy. sci. Belgique Bull., ser. 2, vol. 15, p. 152, pl. 3, fig. 41. (Pliocene, Belgium.)

Polymorphina texana CUSHMAN and APPLIN, *1926*, Am. Assoc. Petroleum Geologists Bull., vol. 10, p. 173, pl. 9, figs. 1, 2. (Upper Eocene, Texas.)

Pseudopolymorphina decora CUSHMAN and OZAWA *1930*, U. S. Nat. Mus. Proc. vol. 77, art. 6, p. 96, pl. 24, figs. 6–8. (Eocene to Miocene.) CUSHMAN, *1935*, U. S. Geol. Survey. Prof. Paper, 181 p. 29, pl. 10, figs. 11, 12. (Upper Eocene, Texas.)

Test elongate, somewhat compressed, periphery rounded; chambers distinct, longer than wide, not inflated, early chambers guttuline, later chambers alternating; sutures distinct, not depressed; wall smooth; aperture radiate. Length 1.41 mm.; width 0.62 mm.; thickness 0.42 mm.

Hypotype.—Princeton University no. 50831.

Locality.—Section 2.

Remarks.—The specimen illustrated was the only one found in the Salt Mountain limestone. It has the long chambers characteristic of *P. decora*. A similar form has been recorded from the Jackson Eocene in the Gulf Coastal Plain and referred to this species. The Salt Mountain specimen is much larger than the Jackson Eocene hypotypes in the Cushman collection.

Genus SIGMOMORPHINA Cushman
and Ozawa, 1928
SIGMOMORPHINA cf. S. WILCOXENSIS
Cushman and Ponton
Plate 80, figure 15

Test very elongate, much compressed, periphery rounded; chambers distinct, early chambers in an elongate spiral, later chambers alternating, each succeeding chamber much farther from the base, in the later portion of the test becoming almost uniserial, very slightly if at all inflated; sutures not very distinct, somewhat depressed in the later portion of the test; wall smooth; aperture radiate, much produced, at the end of a cylindrical neck. Length up to 1.47 mm.; width up to 0.37 mm.; thickness up to 0.26 mm.

Depository.—Princeton University no. 50832.

Locality.—Station 2.

Remarks.—This very elongate flattened *Sigmomorphina* with the greatly produced aperture is easy to recognize, but is very rare in the formations studied. Only four specimens were found. It is smaller and more elongate than the holotype of *S. wilcoxensis* and has the aperture at the end of a distinct neck. The other three specimens are longer and more slender than the specimen figured.

Genus POLYMORPHINA d'Orbigny, 1826
POLYMORPHINA SUBRHOMBICA Reuss
Plate 80, figure 16

Polymorphina subrhombica REUSS, *1861* (*1862*).

Sitz. Akad. Wiss. Wien. vol. 44, pt. 1, p. 339, pl. 7, fig. 3. (Vincentown formation, New Jersey.) CUSHMAN and OZAWA, *1930*, U. S. Nat. Mus. Proc., vol. 77, art. 6, p. 114, pl. 30, figs. 1–3. (Vincentown formation, New Jersey.) JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 183, pl. 30, fig. 7. (Hornerstown formation, New Jersey.)

Test large, elongate in adult specimens, somewhat compressed, greatest thickness in the middle, outline of adult rhomboidal, peripheral margin narrowly rounded; chambers broad, alternating; wall smooth; sutures somewhat indistinct, flush with the surface; aperture produced, radiate. Length up to 1.84 mm.; width up to 0.88 mm.; thickness up to 0.55 mm.

Hypotype.—Princeton University no. 50833.

Locality.—Station 2.

Remarks.—This is a common form in the Wilcox formations studied in the Salt Mountain area. In the Wilcox marl bed, Station 3, the specimens are large and typically developed. The majority of the Salt Mountain specimens are smaller, more compressed along the median line of the test, and have fewer chambers. Specimens from Station 3 seem to be identical with topotypes of the species from the Vincentown limesand except that the latter specimens are somewhat broader toward the apertural end. The Alabama specimens, however, seem to come within the range of variation of the species. This species is probably a good guide fossil for this section of the Eocene. A related species, *Polymorphina cushmani* Plummer, occurs in the Midway group of Texas and Alabama but *P. subrhombica* replaces it in the upper Midway at Matthews Landing.

Genus POLYMORPHINELLA Cushman and Hanzawa, 1936

POLYMORPHINELLA ELONGATA Toulmin, n. sp.

Plate 80, figures 17, 18

Test very elongate, subcircular in transverse section, dorsal margin slightly concave, ventral margin equally convex and parallel to the dorsal margin, dentaline in outline; chambers very slightly inflated, biserially arranged in the early portion of the test, each chamber visible its full length on only one side of the test, greatly overlapping, extending down on one side of the test toward the base and overlapping the upper portion of as many as four or five of the preceding chambers, final chambers uniserial in the adult; sutures distinct, slightly depressed; wall smooth; aperture radiate, at the dorsal margin of the final chamber. Length 1 to more than 1.7 mm.; diameter up to 0.37 mm.

Holotype.—Princeton University no. 50834.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—*P. elongata* differs from previously described species of the genus in being more slender, in being subcircular in transverse section, in having chambers that are more overlapping, and in having the dorsal margin concave.

POLYMORPHINELLA SUBCOMPRESSA Toulmin, n. sp.

Plate 80, figures 19, 20

Test very slightly compressed, elongate, elliptical in transverse section, dorsal margin nearly straight to slightly convex, ventral margin nearly straight or slightly concave, except along the final chamber where it is convex, periphery rather broadly rounded; chambers biserial in the early portion of the test, becoming uniserial in the adult, overlapping chambers very slightly inflated, in the early portion of the test each chamber visible in its full length on one side of the test and only its upper portion on the opposite side; sutures distinct, not depressed; wall smooth; aperture radiate, at the dorsal margin of the final chamber. Length up to 1.75 mm.; width up to 0.35 mm.; thickness up to 0.28 mm.

Holotype.—Princeton University no. 50835.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—This species differs from *P. compressa* Cushman and Hanzawa in being more slender and elongate, and in having the ventral margin nearly straight or concave. The ventral margin of *P. compressa* is strongly convex.

Genus RAMULINA Rupert Jones, 1875

RAMULINA GLOBULIFERA H. B. Brady

Plate 80, figure 21

Ramulina globulifera H. B. BRADY, *1879*, Mic. Soc. Quart. Jour., vol. 19, p. 272, pl. 8, figs. 32, 33. WHITE, *1928*, Jour. Paleontology, vol. 2, p.

214, pl. 29, fig. 2. (U. Cretaceous, Mexico.) PLUMMER, *1931*, Univ. Texas Bull. 3101, p. 174, pl. 11, fig. 15. (U. Cretaceous, Texas.)

Ramulina cf. *aculeata* CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 64, pl. 11, figs. 13, 14. (Midway group, Alabama.)

Inflated segments of this species with hispid wall and three or four stolon tubes are frequent in the formation. It has also been observed in the Sucarnoochee clay at Livingston, Alabama. Length of large fragment illustrated 1.2 mm.

Hypotype.—Princeton University no. 50836.

Locality.—Station 2.

Family NONIONIDAE

Genus NONIONELLA Cushman, 1926

NONIONELLA INSECTA (Schwager)

Plate 80, figure 22

Anomalina insecta SCHWAGER, *1883*, Palaeontographica, vol. 30, Pal. Theil, p. 128, pl. 28 (5), figs. 1a–d, 2a–e. (Eocene, Egypt.)

Nonionella insecta CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 65, pl. 8, figs. 13, 14. (Wilcox group, Ozark, Alabama.) GLAESSNER, *1937*, Moscow Univ. Publ. Lab. Paleontology, vol. II–III, p. 368. (Lower Tertiary, Caucasus.) CUSHMAN, *1939*, U. S. Geol. Survey. Prof. Paper 191, p. 29, pl. 8. fig. 1. (Eocene, Egypt, Alabama.)

This species is very close to Schwager's figures of *N. insecta* and appears to be the same. It is also the same as the species from the upper Wilcox which Cushman and Ponton refer to *N. insecta*. It is present in the marl at Hatchetigbee Bluff, Alabama. It is very rare in the Wilcox formations in the vicinity of Salt Mountain. The chambers of this species are inequilateral and oblique, and it is easily distinguished from *N. turgida* by the final chamber, which, in the latter species, extends down to the base of the test and overlaps the coiled portion. Length 0.26–0.46 mm.; width 0.18–0.35 mm.

Hypotype.—Princeton University no. 50837.

Locality.—Station 2.

NONIONELLA TURGIDA (Williamson)

Plate 80, figure 23

Rotalina turgida WILLIAMSON, *1858*, On the Recent Foraminifera of Great Britain, p. 50, pl. 4, figs. 95–97, Royal Soc. London. (Recent, Atlantic Ocean.)

Nonionina turgida (Williamson). H. B. BRADY, *1864*, Linnean Soc. London Trans., vol. 24, p. 474; *1884*, *Challenger* Rept., Zool., vol. 9, p. 731, pl. 109, figs. 17–19. (Recent.) PLUMMER *1927*, Univ. Texas Bull. 2644, p. 159, pl. 12, figs. 6, 7. (Midway group, Texas.) CUSHMAN, *1930*, U. S. Nat. Mus. Bull. 104, pt. 7, p. 15, pl. 6, figs. 1–4. (Recent, Atlantic Ocean.) HOWE and WALLACE, *1932*, Louisiana Dept. Cons., Geol. Bull. No. 2, p. 53, pl. 9, figs. 2a–c. (Upper Eocene, Louisiana.) COLE, *1938*, Florida Geol. Survey Bull. 16, pl. 1, fig. 9. (Midway group (well core), Florida.) CUSHMAN, *1939*, U. S. Geol. Survey, Prof. Paper 191, p. 32, pl. 9, figs. 2, 3. (See this reference for further synonymy.)

This small form with inequilateral development of chambers is the same as Williamson's species. The last chamber is very long and overlaps the umbilical region in many specimens. The species is common in the limestone, but rare in the Wilcox marl of the Salt Mountain region. Length up to 0.37 mm., average 0.3 mm.; width up to 0.26 mm., average 0.18 mm.

Hypotype.—Princeton University no. 50838.

Locality.—Station 2.

Family HETEROHELICIDAE

Genus GÜMBELLINA Egger, 1899

GÜMBELLINA WILCOXENSIS

Cushman and Ponton

Plate 80, figure 24

Gümbelina wilcoxensis CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 66, pl. 8, figs. 16, 17. (Wilcox group, Ozark, Alabama.)

Test minute, biserial, somewhat compressed, periphery lobate, broadly rounded; chambers distinct, much inflated, enlarging very rapidly, the last four chambers of the adult making up a considerable proportion of the test; sutures distinct, much depressed; wall papillate; aperture a low arched opening at the base of the last chamber. Length up to 0.35 mm.; width up to 0.22 mm.; thickness up to 0.17 mm.

Hypotype.—Princeton University no. 50839.

Locality.—Station 2.

Remarks.—This species is fairly common in the Salt Mountain limestone. It has also been observed in the marl at Gregg's Landing (Tuscahoma formation), Alabama.

Family BULIMINIDAE

Genus BULIMINA d'Orbigny, 1826

BULIMINA OVATA d'Orbigny

Plate 80, figures 25, 26

Bulimina ovata D'ORBIGNY. *1846*, Foram. Foss. Bass. Tert. Vienne, p. 185, pl. 11, figs. 13, 14. (Miocene, Austria.) CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr.,

vol. 8, p. 67, pl. 9, figs. 1, 2. (Wilcox group, Ozark, Alabama.) CUSHMAN and PARKER, *1936*, Cushman Lab. Foram. Research Contr., vol. 13, p. 47, pl. 6, figs. 4, 5. (Eocene, Austria.) GLAESSNER, *1937*, Moscow Univ. Publ. Lab. Paleontology, vols. II–III, p. 371. (Lower Tertiary, Caucasus.)

Test elongate, slender, ovate to elliptical in outline, about equally rounded at the apertural and initial ends, tapering gently toward each end, almost circular in transverse section; chambers elongate, distinct, very slightly inflated; sutures distinct, slightly depressed; wall smooth; aperture narrow, on the inner side of the last chamber. Length up to 0.83 mm., average 0.5 mm.; diameter up to 0.3 mm., average 0.22 mm.

Hypotypes.—Princeton University nos. 50841, 52294.

Locality.—Station 3.

Remarks.—This species is frequent in the Salt Mountain limestone at some localities and is common in the Wilcox marl above the Salt Mountain limestone. A large proportion of the specimens in the Wilcox marl are very elongate and slenderly elliptical in outline. *B. ovata* is present in the Nanafalia and Tuscahoma formations of Alabama.

BULIMINA cf. B. PROLIXA
Cushman and Parker
Plate 80, figure 27

Test about twice as long as broad, subcircular to very faintly triangular in section, gradually and evenly tapering, apertural end blunt or flattened; chambers very short, distinct, very slightly if at all inflated, five or six whorls, chambers in adjacent whorls lying above one another; sutures distinct, very slightly if at all depressed; wall smooth; aperture an elongate opening at the end of the final chamber. Length 0.44 mm.; diameter 0.22 mm.

Depository.—Princeton University no. 52295.

Locality.—Station 1.

Remarks.—These Wilcox specimens resemble *B. prolixa* from the Cretaceous of Tennessee in the shape and arrangement of chambers, but are larger and stouter than the Cretaceous specimens and more nearly circular in transverse section. The apertural end is also much more flattened. They also resemble specimens from the Eocene of Cuba referred to *B. tuxpamensis* Cole by Parker and Bermudez. The species is rare in this part of the Wilcox section. Only five specimens have been found. All are from the Salt Mountain limestone at Station 1 and Station 6. All the specimens observed keep their characters closely, but it is probably unwise to give this form a specific name on the basis of such a small number of specimens.

Genus LOXOSTOMA Ehrenberg, 1854
LOXOSTOMA sp.
Plate 80, figure 28

One broken specimen of a *Loxostoma* was found in the Salt Mountain limestone. It is

EXPLANATION OF PLATE 82

All specimens are from the Salt Mountain limestone of Wilcox Eocene age, Clarke County, Alabama, unless otherwise indicated.

FIGS. *1, 2—Globigerina compressa* Plummer, Hypotype, Princeton Univ. 52318, from Station 2. ×50. *1*, Dorsal view, *2*, Peripheral view. (p. 607)

3—Globigerina triloculinoides Plummer. Dorsal view of hypotype, Princeton Univ. 52319, from Station 2. ×62. (p. 607)

4, 5—Globorotalia membranacea (Ehrenberg). Hypotype, Princeton Univ. 52320, from Station 2. ×62. *4*, Dorsal view. *5*, Ventral view. (p. 608)

6–8—Globorotalia wilcoxensis Cushman and Ponton var. *acuta* Toulmin, n. var. Holotype, Princeton Univ. 52321, from Station 2. ×60. *6*, Dorsal view, *7*, Peripheral view. *8*, Ventral view. (p. 608)

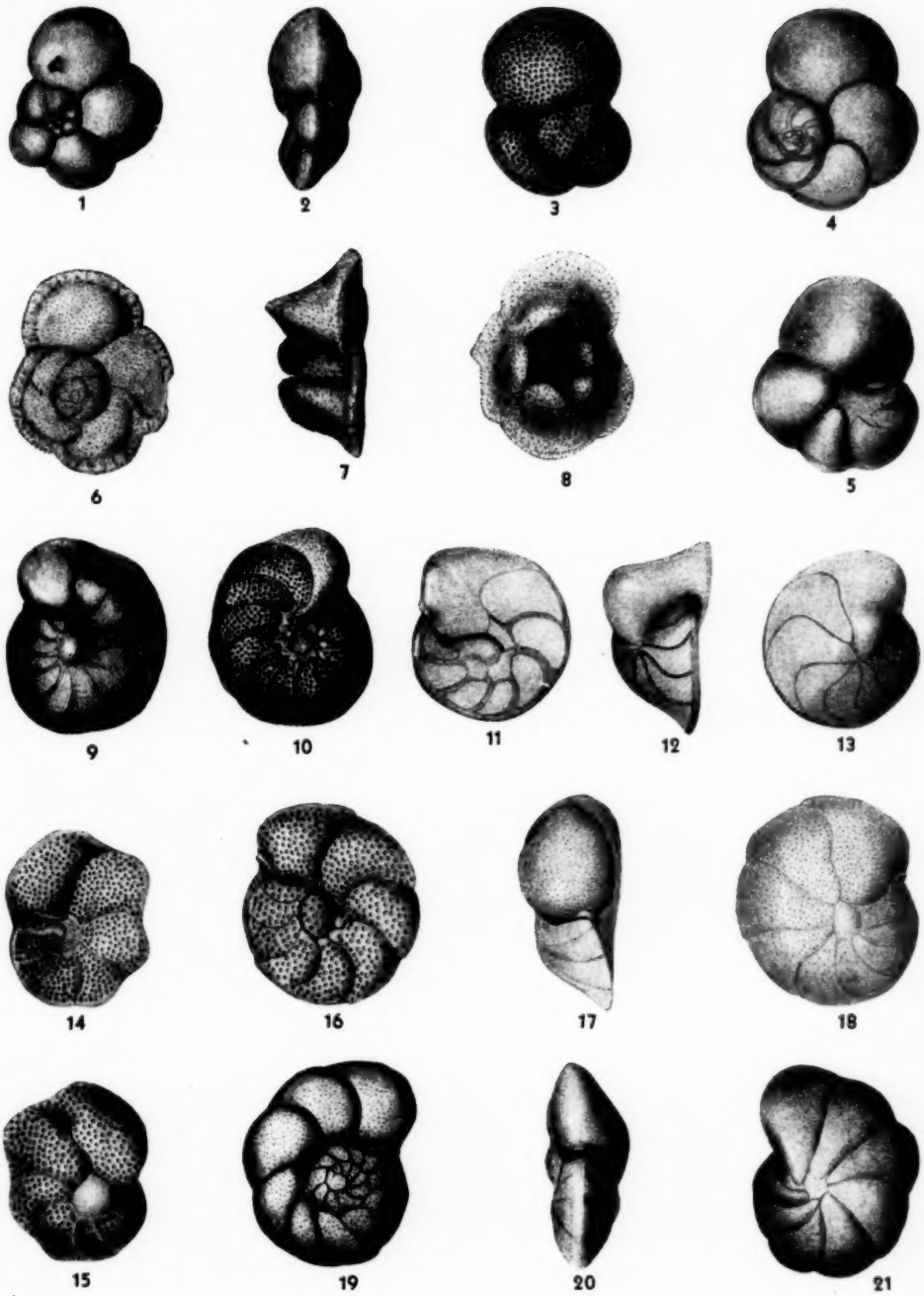
9, 10—Anomalina acuta Plummer. Hypotype, Princeton Univ. 52322, from Station 2. ×60. *9*, Dorsal view. *10*, Ventral view. (p. 608)

11–13—Cibicides blanpiedi Toulmin, n. sp. Holotype, Princeton Univ. 52325, from Station 2. ×70. *11*, Dorsal view. *12*, Peripheral view. *13*, Ventral view. (p. 609)

14, 15—Cibicides burlingtonensis Jennings. Hypotype, Princeton Univ. 52323, from Station 2. ×30. *14*, Dorsal view. *15*, Ventral view. (p. 609)

16–18—Cibicides howelli Toulmin, n. sp. Holotype, Princeton Univ. 52324, from Station 2. ×60. *16*, Dorsal view. *17*, Peripheral view. *18*, Ventral view. (p. 609)

19–21—Cibicides præcursorius (Schwager). Hypotype, Princeton Univ. 52326, from Station 2. ×70. *19*, Dorsal view. *20*, Peripheral view. *21*, Ventral view. (p. 610)



Toulmin, Eocene Foraminifera

UNIV. OF MICH.

somewhat larger than *L. wilcoxense* Cushman and Ponton from the upper Wilcox group. A few specimens of *L. wilcoxense* were obtained from the Wilcox marl at Station 3. The specimen from the limestone is similar to specimens found in a sample of Sucarnoochee clay collected by Miss McGlamery just above the contact with the Selma chalk west of the bridge over Sucarnoochee Creek, Livingston, Alabama. Length of fragment 0.37 mm.; width 0.17 mm.

Depository.—Princeton University no. 52296.

Locality.—Station 2.

Genus BIFARENA Parker and Jones, 1872
BIFARINA sp.
Plate 80, figure 29

Test elongate, early portion biserial and comprising about half the test in the majority of specimens, later portion consisting of a very few alternately oblique chambers; chambers very slightly if at all inflated in the biserial portion of the test, becoming more inflated in the later portion; sutures slightly depressed, becoming more deeply depressed in the later portion of the test and very oblique to the axis of the test in alternating directions; wall faintly striate in the biserial portion of the test, becoming smooth in the later portion, coarsely punctate; aperture terminal, elliptical. Length 0.44 mm.; width 0.15 mm.

Depository.—Princeton University no. 52297.

Locality.—Station 2.

Remarks.—This is a rare species in this part of the Alabama Wilcox section. Very few specimens were found. All were from the Salt Mountain limestone. It resembles the much smaller Midway species *Rectogümbelina alabamensis* described by Cushman (1940, p. 65), but it does not have the raised apertural rim and the chambers in the biserial portion of the test are not inflated. It bears a close superficial resemblance to *Siphogenerina eleganta* Plummer of the Midway group in Texas, but there are fewer uniserial chambers in the Salt Mountain specimens. Cushman (1940, p. 66) figured a test from the Midway of Alabama which he referred to *Siphogenerinoides eleganta* (Plummer). The early chambers were reported to be arranged triserially.

Genus ANGULOGERINA Cushman, 1927;
ANGULOGERINA WILCOXENSIS
(Cushman and Ponton)
Plate 80, figure 30

Pseudouvigerina wilcoxensis CUSHMAN and PONTON, *1932*, Cush. Lab. Foram. Research Contr., vol. 8, p. 66, pl. 8, figs. 18a, b. (Wilcox group, Ozark, Alabama.) GLAESSNER, *1937*, Moscow Univ. Publ. Lab. Paleontology, vols. II–III, p. 374, pl. 2, figs. 21a, b. (Lower Tertiary, Caucasus.)

Angulogerina wilcoxensis CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 84, pl. 14, figs. 24, 25 (Wilcox group, Woods Bluff, Alabama.)

Test small, elongate, triangular in transverse section, with short neck and phialine lip; chambers triangular with truncate periphery, not inflated, triserial; sutures fairly distinct, very slightly if at all depressed, strongly curved; wall smooth, perforate; aperture terminal at the end of the short neck. Length 0.31 mm.; width 0.16 mm.

Hypotype.—Princeton University no. 50840.

Locality.—Station 2.

Remarks.—This minute species is frequent in the Salt Mountain limestone. It is more abundant in the Wilcox marl that overlies the limestone along Richmond Branch, Station 3. It has been observed also in the Tuscahoma, Bashi, and Hatchetigbee formations.

Family ROTALIIDAE
Genus PATELLINA Williamson, 1858
PATELLINA sp.
Plate 80, figures 31, 32

A single large specimen of *Patellina* and two somewhat smaller specimens were found in the Salt Mountain limestone. Because of the rarity of the genus in this portion of the Tertiary section its occurrence is considered worthy of note. The largest specimen is illustrated. Diameter 0.79 mm.; height 0.24 mm.

Depository.—Princeton University no. 52298.

Locality.—Station 2.

Genus PATELLINOIDES Heron-Allen and Earland, 1932
PATELLINOIDES? sp.
Plate 80, figure 33

Two specimens of the form illustrated

were found in the Salt Mountain limestone. The species has rather distinctive characters, being very flat with chambers clearly outlined, two to a whorl. The periphery is not thickened. The apex is gone so that the arrangement of the early chambers is not known. The genus may be *Patellinella*. Diameter 1.01 mm.

Depository.—Princeton University no. 52299.

Locality.—Station 4-j.

Genus PATELLINELLA Cushman, 1928

PATELLINELLA? sp.

Plate 80, figure 34

Three specimens of a *Patellinella?* with a subconical test were recovered from the limestone. The apex is broken off, but there are two adult chambers to a whorl. It differs from *Patellinoides?* sp. in having a thickened periphery, in being more conical, in having narrower chambers, and in having more whorls. Length 1.07 mm.; width 0.86 mm.

Depository.—Princeton University no. 52300.

Locality.—Station 1.

Genus DISCORBIS Lamarck, 1804

DISCORBIS RUKASI Howe

Plate 80, figures 35, 36

Discorbis rukasi HOWE, *1939*, Louisiana Dept. Cons., Geol. Bull. No. 14, p. 74, pl. 10, figs. 25, 26. (Claiborne group, Louisiana.)

Test trochiform, compressed, convex dorsally, somewhat concave ventrally, periphery lobate, bluntly angular with a thickened edge; chambers distinct, slightly inflated, final chambers of large specimens considerably inflated, six to eight in number in the final whorl, increasing rather rapidly in size as added; sutures distinct, curved, on the dorsal side limbate and raised, joining with the thickened peripheral edge, depressed between the greatly inflated later chambers, sutures on the ventral side non-limbate, depressed; wall papillate on the final chambers of large specimens; aperture an elongate opening on the ventral side between the periphery and the umbilicus. Length up to 1.7 mm., average 1.01 mm.; width up to 1.32 mm., average 0.88 mm.; thickness 0.46 mm. to 0.64 mm.

Hypotype.—Princeton University no. 52301.

Locality.—Station 1.

Remarks.—This large distinctive species is very common throughout the Salt Mountain limestone, but not a single specimen was discovered in the Wilcox marl. This species has not been observed in any other Alabama Wilcox outcrops.

DISCORBIS sp. A

Plate 80, figure 37; text figure 4 H, I

A single specimen of a compressed *Discorbis* having distinct, curved sutures and a narrowly rounded periphery was found. It is subcircular in outline. The test is covered with extremely fine spinose processes, most noticeable around the periphery. The same form is very common in the Vincentown limesand of New Jersey. Diameter 0.44. mm.; thickness 0.16 mm.

Depository.—Princeton University no. 52302.

Locality.—Station 2.

DISCORBIS sp. B

Plate 81, figures 1, 2; text figure 4 D

Test small, circular in outline, trochiform, planoconvex or concavoconvex, dorsal side strongly convex, ventral side flat or slightly concave, with an umbilical boss, periphery acute, very slightly lobate; chambers five or six in the final whorl, narrow, curved, not inflated; sutures distinct, strongly curved on the dorsal side, somewhat limbate, flush with the surface, on the ventral side non-limbate, slightly depressed, moderately curved; wall very smooth, polished; aperture a narrow arched opening on the ventral side at the base of the final chamber. Diameter 0.22 mm.; height 0.12 mm.

Depository.—Princeton University no. 52303.

Locality.—Station 2.

Remarks.—This form is very rare in the limestone. It has not been observed in any other formation except the Naheola and upper Midway limestone of east Alabama.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA SOLDANII d'Orbigny var. OCTOCAMERATA Cushman and G. D. Hanna

Plate 81, figures 3–5

Gyroidina soldanii var. *octocamerata* CUSHMAN and G. D. HANNA, *1927*, California Acad. Sci. Proc., ser. 4, vol. 16, p. 223, pl. 14, figs. 16–18. (Eocene, California.) COLE, *1927*, Bull. Am.

Paleontology, vol. 14, p. 29, pl. 2, figs. 21–23. (Guayabal formation, Eocene, Mexico.) CUSHMAN and SCHENK, *1928*, California Univ. Dept. Geol. Sci. Bull. vol. 17, p. 312, pl. 44, figs. 3–5. (Tertiary, Oregon.) WEINZIERL and APPLIN, *1929*, Jour. Paleontology, vol. 3, p. 406. (Claiborne group, Texas.) CUSHMAN and THOMAS, *1930*, Jour. Paleontology, vol. 4, p. 40, pl. 4, figs. 2, 3. (Claiborne group, Texas.) CUSHMAN, *1935*, U. S. Geol. Survey, Prof. Paper 181, p. 45, pl. 18, figs. 4a–c. (Upper Eocene, Coastal Plain.) GLAESSNER, *1937*, Moscow Univ. Publ. Lab. Paleontology, vols. II–III, p. 379, pl. 3, figs. 27a–c. (Lower Tertiary, Caucasus.) HOWE, *1939*, Louisiana Dept. Cons., Geol. Bull. No. 14, p. 75, pl. 9, figs. 34–36. (Claiborne group, Louisiana.)

Valvulineria scrobiculata CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 70, pl. 9, figs. 5a–c. (Wilcox group, Ozark, Alabama.) CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 85, pl. 14, figs. 32, 33. (Wilcox group, Woods Bluff, Alabama.)

Gyroidina scrobiculata ISRAELSKY, *1939*, Sixth Pacific Sci. Cong. Proc., p. 578, pl. 4, figs. 4–6. (Eocene, California.)

Test subcircular in outline, dorsal side somewhat flattened, ventral side very convex, periphery broadly rounded, umbilical area depressed on the ventral side; chambers distinct, 7 to 10 in the final whorl, increasing regularly in size as added; sutures distinct, nearly straight on the ventral side, rather strongly curved on the dorsal side, slightly depressed in the later portion of the test; wall smooth, polished, very finely perforate; aperture a low opening at the base of the final chamber, extending from the periphery to the umbilical region on the ventral side, covered in well-preserved specimens by a flattened lip projecting over the umbilicus. Dimensions of average specimen: length 0.41 mm.; width 0.32 mm.; thickness 0.24 mm.

Hypotype.—Princeton University no. 52304.

Locality.—Station 2.

Remarks.—This species differs from "*Anomalina*" *scrobiculata* Schwager in having a much more broadly rounded periphery, in being more strongly convex ventrally, and in having straight instead of curved sutures on the ventral side. The final chamber of the variety *octocamerata* is much higher than that of "*A.*" *scrobiculata* which is somewhat compressed. It differs from the Midway variety *subangulata* (Plummer) in not having a distinct peripheral angle, but instead has a broadly rounded periphery. The Wilcox specimens seem to be identical with those from the Claiborne and Jackson of Alabama.

This is one of the most common species in the Wilcox section of Alabama. It is abundant in the upper Wilcox material from Ozark, Alabama, in the *Ostrea thirsae* marl of the Nanafalia formation, and in the Tuscahoma, Bashi, and Hatchetigbee formations. In the Salt Mountain area it is abundant in the Salt Mountain limestone and in the overlying Wilcox marl.

Genus EPONIDES Montfort, 1808

EPONIDES BOUEANA (d'Orbigny)

Plate 81, figures 6, 7

Rotalina boueana D'ORBIGNY, *1846*, Foram. Foss. Bass. Tert. Vienne, p. 152, pl. 7, figs. 25–27. (Miocene, Austria.)

Test trochiform, biconvex, ventral side more strongly convex, peripheral margin acute, carinate; chambers distinct, seven or eight in number in the last whorl, increasing regularly in size as added; sutures distinct, on the dorsal side marked by broad bands of clear shell material, slightly elevated, curved, on the ventral side depressed, radial; wall coarsely punctate on the dorsal side; aperture a slit on the ventral side at the base of the final chamber between the periphery and the umbilicus. Length 0.30 mm.; width 0.24 mm.; thickness 0.16 mm.

Hypotype.—Princeton University no. 52305.

Locality.—Station 2.

Remarks.—This form agrees very closely in its characters with the species described by d'Orbigny from the Vienna Basin. It is rare in the limestone in the vicinity of Salt Mountain.

EPONIDES DORFI Toulmin, n. sp.

Plate 81, figures 8, 9; text figure 4 E

Test circular in outline, dorsal side strongly convex, ventral side flat except for the inflated chambers, periphery very slightly if at all lobate, rather sharply rounded, not keeled; chambers somewhat inflated on the ventral side, six to eight in the last-formed coil; sutures distinct, gently curved, oblique and flush with the surface on the dorsal side, slightly depressed on the ventral side; wall smooth, perforate; aperture a long slit on the ventral side at the base of the final chamber, extending from

the umbilicus nearly to the periphery. Diameter 0.44 mm.; height 0.24 mm.

Holotype.—Princeton University no. 52306.

Locality.—Station 2.

Remarks.—This species is frequent in the Salt Mountain limestone and common in the overlying Wilcox marl at Station 3. It is common in the Nanafalia formation of lower Wilcox age. It differs from the upper Wilcox form from Ozark and Woods Bluff, Alabama, referred to *Eponides lotus* (Schwager), in having a more strongly convex dorsal side, flatter ventral side, nonlobate or very faintly lobate periphery, and dorsal sutures that are flush with the surface or only slightly depressed.

Israelsky (1939, p. 578, pl. 5, figs. 1–4; pl. 6, fig. 1) figured several forms that were referred to *Eponides lotus*, including a specimen from the Nanafalia formation and one from the Wilcox group at Ozark, Alabama. Suites of specimens from Nanafalia and from Ozark can be distinguished, but because of individual variation a few specimens from each formation will resemble one another. The California Eocene specimens that are figured show both extremes of development. Without examining a suite of specimens it is not possible to tell whether the California species is the same as that of the lower Wilcox or the upper Wilcox.

Genus ALABAMINA Toulmin, n. gen.

Genotype: *Alabamina wilcoxensis* TOULMIN, n. sp. [=*Pulvinulinella exigua* (H. B. Brady) var. *obtusa* (Burrows and Holland), of Cushman and Ponton, 1932, no Burrows and Holland, 1897.]

Test trochiform, usually biconvex, umbilical area closed, periphery bluntly acute or narrowly rounded; all chambers visible from the dorsal side only; dorsal sutures oblique, straight or very gently curved, ventral sutures radiate, straight or slightly curved; wall calcareous, finely perforate; aperture a long narrow opening on the ventral side along the base of the septal face, with supplementary false aperture, consisting of a deep indentation of the wall of the septal face, which is parallel to the periphery on the ventral side and carries no opening into the interior of the chamber.

Remarks.—A careful study of sectioned specimens shows that the aperture of the genotype is along the base of the septal face between the peripheral indentation and the umbilical area. The opening does not extend into the peripheral indentation of the septal face, which is the critical character of the genus. The species therefore, certainly does not belong in the genus *Pulvinulinella* of the Cassidulinidae. The species cited by Montfort in 1808 as the genotype of *Eponides* was *Nautilus repandus* Fichtel and Moll, which has an aperture in the form of a narrow slit on the ventral side at the base of the final chamber, extending from a point near the periphery nearly to the umbilical area, and the septal face is smooth. Illustrations show that the apertural slit does not open into an umbilicus. At the present time it is the custom to place species having the aperture opening into the umbilicus also in the genus *Eponides*. The characteristic infolding of the wall of the septal face near the periphery to produce a false aperture parallel to the plane of coiling distinguishes *Alabamina* from *Eponides* and from other genera of the Rotaliidae.

The structure of the test of *A. wilcoxensis* is shown in the line drawings of sectioned specimens, text figures 4 A–C. Figure 4 A shows a complete specimen with only the ventral wall of the final chamber removed. Figure 4 B shows a specimen with all the ventral wall and septal face removed leaving only the dorsal wall and peripheral portions of the final chamber. Figure 4 *C* is an ideal section through the final chamber along the line *ab* to show the folding of the wall which produces the peripheral indentation. The dorsal wall of the final chamber comes forward to the peripheral edge at *c*, doubles back to the edge *d*, then folds forward again to *e*, and extends toward *f* (fig. 4 A) to form the apertural face. The true apertural opening is at the base of this face between *f* and *g*. There is no opening into the interior of the chamber between *g* and *e*. The fold of the wall is attached to a preceding chamber at *g*. In the area between *d*, *e*, and *g* the folding produces a triple thickness of the wall. This area can be seen from the dorsal side of clear specimens. The foramen between the last chamber and the penultimate chamber is shown at *h*. It is a subtriangular opening, broad dorsally and narrowing to a point ventrally.

ALABAMINA WILCOXENSIS Toulmin, n. sp.
Plate 81, figures 10–14; text figure 4 A–C

Pulvinulinella exigua var. *obtusa* CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 71, pl. 9, figs. 9a–c. (Wilcox group, Ozark, Alabama.) JENNINGS, *1936*, Bull. Amer. Paleontology, vol. 23, p. 192, pl. 31, figs. 4a, b. (Hornerstown formation, New Jersey.) HOWE, *1939*, Louisiana Dept. Cons., Geol. Bull. No. 14, p. 81, pl. 11, figs. 4–6. (Claiborne group, Louisiana.)
Pulvinulinella obtusa CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 87, pl. 15, figs. 12, 93. (Wilcox group, Woods Bluff, Alabama.)

Test trochiform, close coiled, subcircular in outline, unequally biconvex or planoconvex, ventral side strongly convex, periphery bluntly acute; five or six chambers in the final whorl; wall smooth, finely perforate; sutures flush with the surface, on the dorsal side almost straight, oblique to the periphery, on the ventral side radial; aperture a long narrow opening on the ventral side at the base of the septal face, with a supplementary indentation extending peripherally from the true aperture, formed by a fold in the wall of the test and not opening into the interior of the chamber. Diameter up to 0.42 mm.; height up to 0.21 mm.

Holotype.—Princeton University no. 52308.

Locality.—Upper Wilcox, from railroad cut one mile north of Ozark, Alabama.

Paratypes.—Princeton University no. 52309, from upper Wilcox railroad cut, one mile north of Ozark, Alabama; no. 52307 from Salt Mountain limestone, Richmond Branch, half a mile north of Salt Mountain, Station 2.

Remarks.—This species differs from "*Pulvinulina*" *exigua* var. *obtusa* B. and H. of the Thanet beds and from the Midway form referred to "*Pulvinulina*" *exigua* var. *obtusa*, in being considerably larger and in having a more acute peripheral angle. Both the English and the Texas Midway forms are more tumid than the upper Wilcox species. The Wilcox specimens are closer to the Midway specimens referred to the species "*Pulvinulina*" *exigua* (H. B. Brady). Both have peripheral angles that are bluntly acute, but the upper Wilcox specimens are unequally biconvex, having a more flattened dorsal side, and the ventral side does not have an umbilical filling. The average size of the upper Wilcox specimens is greater. The Midway form "*P.*" *exigua* (H. B. Brady), of Plummer, occurs in the Nanafalia and Tuscahoma formations (lower Wilcox) of Alabama. *Alabamina wilcoxensis*, n. sp., is common in the Salt Mountain limestone, the Wilcox marl at Station 3, the greensand marl at Ozark, and the Bashi and Hatchetigbee formations of Alabama. It is present in the Hornerstown and Vincentown formations of New Jersey. The form figured by Israelsky (1939, p. 579, pl. 7, fig. 4) from the Eocene of California is apparently the Midway species, "*P.*" *exigua* (H. B. Brady).

Genus PARRELLA Finlay, 1939

Genotype: *Anomalina bengalensis* SCHWAGER, *1866*, *Novara*-Exped., Geol. Theil, vol. 2, p. 259, pl. 7, fig. 111. (Pliocene (?) of Kar-Nicobar.)

Test trochiform, planoconvex or unequally biconvex, more or less flattened dorsally, umbilical area filled, periphery acute with a thin flange; all chambers visible dorsally, with peripheral flange of coils preceding the last forming limbate whorl sutures, only chambers of the last-formed coil visible from the ventral side; sutures limbate, oblique and curved on the dorsal side, radiate and often depressed on the ventral side; wall calcareous, perforate; aperture consisting of two portions, an elongate opening in the septal face about half-way between the periphery and the umbilical area, at an angle of 45° to 90° to the peripheral plane, and a short slit extending from the elongate opening along the base of the septal face toward the umbilical area.

Remarks.—The form and position of the aperture (see text figure 4 F, G) especially distinguish this genus from the other genera of the Rotaliidae. The opening extends obliquely across the septal face, and there is an additional slit along the base of the septal face. The aperture of *Pulvinulinella* of the Cassidulinidae is an elongate opening located near the periphery in the septal face and is nearly parallel to the peripheral plane. The base of the septal face between this aperture and the umbilical area is closed.

The aperture in many specimens of *Parrella* is very indistinct, and because of its location is especially likely to be covered by extraneous matter lodged in the crevice at the base of the septal face. A careful study of specimens with features characteristic of

this genus, such as the shape of the chambers on the dorsal side (similar to those in *Epistomina*), unequal biconvexity, and peripheral flange, usually shows the typical aperture to be present.

Species belonging in the genus *Parrella* have been recorded at least from the Cretaceous to the Recent. Species from the

FIG. 3.—*Parrella expansa* Toulmin, n. sp., from the Wills Point formation (Midway group) of Texas, about 3 miles southeast of Corsicana; ×50. *a*, dorsal view. *b*, peripheral view. *c*, ventral view of same specimen. (After Plummer.)

Coastal Plain belonging in this genus include *Pulvinulinella texana* Cushman, 1938, and *Pulvinulinella navarroana* Cushman, 1938, from the Cretaceous of Texas, *Truncatulina velascoensis* Cushman, 1925, from the Velasco of Mexico, *Parrella expansa* Toulmin, n. sp., [=*Truncatulina culter* (Parker and Jones) of Plummer, 1927] from the Wills Point formation (upper Midway) of Texas, *Pulvinulinella culter* (Parker and Jones) var. *mexicana* Cole, 1927, from the Eocene Guayabal of Mexico, and *Pulvinulinella interrupta* Cushman, 1927, from the Alazan of Mexico. According to Nuttall (1930, p. 293) "*P.*" *culter* var. *mexicana* Cole ranges from the Aragón to the lower part of the Alazán in Mexico. *Pulvinulinella culter* (Parker and Jones) has been reported from the Alazán of Mexico by Cushman, 1927, and from the late Tertiary of Ecuador, Venezuela, and Trinidad by Cushman, 1929. A sample from the Weches formation (Claiborne group) from Texas has yielded specimens of this genus. Records indicate that species of *Parrella* are widely distributed in other parts of the world. The genus is represented in the present oceans by one or more species living in the Atlantic and Pacific. A recent specimen with typical apertural characters was obtained from some material from the Caribbean Sea, *Albatross* H386.

PARRELLA EXPANSA Toulmin, n. sp.
Text figures 3, 4 F, G

Truncatulina culter PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 147, pl. 10, figs. 1 a–c; pl. 15, figs. 2 a, b. (Wills Point formation, Midway group, Texas.)

Pulvinulinella culter var. *mexicana* CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 72, pl. 12, fig. 12.

Test trochiform, close coiled, subcircular in outline, ventral side strongly convex, dorsal side nearly flat with earliest coils gently elevated, periphery sharply acute with a broad thin flange; all chambers visible on dorsal side, with flange of all coils forming a limbate whorl suture, only chambers in the final convolution visible ventrally, eight or nine chambers in the final whorl; dorsal sutures broad, oblique, slightly curved, flush or slightly elevated, ventral sutures limbate between early chambers of the final whorl, generally depressed between the last two or three chambers, radiating from a small umbilical filling and curving backward near the junction with the peripheral flange; wall smooth, perforate; aperture consisting of two portions, a narrow elliptical opening extending from the base of the final chamber near the periphery obliquely across the apertural face, at an angle of 45 degrees or more to the peripheral plane, and a very narrow slit at base of the septal face extending ventrally toward the umbilical area from the dorsal end of the oblique opening. Average diameter 0.5 mm.

Holotype.—Princeton University no. 50777.

Locality.—Wills Point formation of Midway group. Abandoned clay pit in west edge of Mexia, Texas.

Remarks.—*P. expansa* differs from the Recent species *P. culter*, in having fewer chambers and fewer whorls. *P. culter* has 9 to 11 chambers in the final whorl. On the dorsal side the sutures are less oblique than those of P. *culter*. *P. expansa* is smaller than the variety *mexicana* and has fewer chambers than shown in the original figure of that variety.

This species was reported to be common in the Wills Point formation (upper Midway) in Texas. In Alabama it is common in samples of Sucarnoochee clay from Sucarnoochee Creek at Livingston. It does not

occur in the Salt Mountain limestone, but does occur in the Wilcox marl bed at Station 3. The description of *P. expansa* is included here to accompany the description of the genus *Parrella*.

Genus SIPHONINA Reuss, 1850
SIPHONINA WILCOXENSIS Cushman
Plate 81, figures 15, 16

Siphonina wilcoxensis CUSHMAN, *1927*, U. S. Nat. Mus. Proc., vol. 72, art. 20, p. 3, pl. 2, figs. 1–3 (Nanafalia, Tuscahoma, and Hatchetigbee formations, Alabama and Mississippi.) CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 70, pl. 9, figs. 7 a–c. (Wilcox group, Ozark, Alabama.) CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 86, pl. 15, figs. 7–9. (Wilcox group, Woods Bluff, Alabama.) ISRAELSKY, *1939*, Sixth Pacific Sci. Cong. Proc., p. 578, pl. 7, fig. 3. (Eocene, California.)

Test subcircular in outline, slightly more convex ventrally, periphery sharply acute and delicately serrate, slightly lobate; chambers five in number in the last whorl, slightly inflated on the ventral side; dorsal sutures flush with the surface, oblique, marked by the serrate edges of the chambers, ventral sutures slightly depressed, nearly radial; surface distinctly punctate; aperture an elongate opening parallel to the periphery on the ventral side, outlined by a narrow lip but without a neck. Diameter up to 0.3 mm.

Hypotype.—Princeton University no. 52310.

Locality.—Station 3.

Remarks.—This species differs from the smaller *Siphonina prima* Plummer from the Midway group of Texas, with which it is most likely to be confused, in being more convex ventrally, and in having more strongly developed apertural characters. It is common in the Wilcox marl at Station 3 and is common in the limestone at some localities. It is common throughout the Wilcox group.

Genus COLEITES Plummer, 1934
COLEITES LAEVIGATUS Toulmin, n. sp.
Plate 81, figures 17–20

Test subcircular to elongate, compressed, about equally biconvex, periphery acute with narrow indistinct flange; early chambers tightly coiled, later chambers in mature specimens becoming uncoiled, six or seven in number in the final whorl, overlapping, narrow and curved in the earlier portion of the test, becoming broader in the later portion, final chamber as broad as long; sutures on the dorsal side usually indistinct, flush with the surface, limbate, curved, meeting the periphery at an acute angle and merging into the peripheral flange, ventral sutures simple, depressed, earlier ones curved, be-

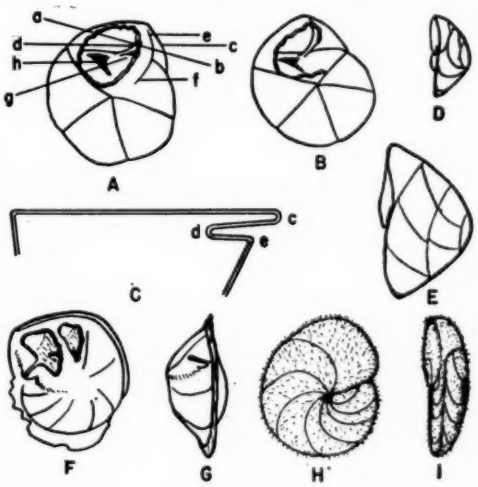


FIG. *4.*—*A–C, Alabamina wilcoxensis* Toulmin, n. sp., from the upper Wilcox of Ozark, Alabama, showing the structure of the test. *A*, Ventral view of a specimen with a portion of the ventral wall of the final chamber removed. ×50. *B*, Ventral view of another specimen with the ventral wall and septal face of the final chamber removed. ×50. *C*, Ideal section through the anterior portion of the final chamber and across the fold in the septal face along the line *ab*, showing the unbroken outer wall of the test in the peripheral indentation of the septal face. ×105. (p. 603)
D, Discorbis sp. *B*. Peripheral view, Princeton Univ. 52303, from Station 2. ×50. (p. 600)
E, Eponides dorfi Toulmin, n. sp. Peripheral view of holotype, Princeton Univ. 52306, from Station 2. ×50. (p. 601)
F, G, Parrella expansa Toulmin, n. sp., from the Wills Point formation (upper Midway) of Texas. ×40. *F*, Ventral view of a specimen with the ventral wall of the last two chambers removed. *G*. Peripheral view of holotype showing detail of the aperture. Princeton Univ. no. 50777. (p. 604)
H, I, Discorbis sp. *A*. Princeton Univ. 52302, from Station 2. ×40. *H*, Ventral view. *I*, Peripheral view. (p. 600)

coming straight in the later evolute portion of the test; wall rather coarsely perforate; aperture an elliptical opening adjacent and parallel to the periphery on the ventral side. Diameter up to 0.7 mm.; thickness up to 0.33 mm.

Holotype.—Princeton University no. 52312.

Paratypes.—Princeton University nos. 52311, 52313.

Locality.—Salt Mountain limestone, from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—This species lacks the distinctive ornamentation of *C. reticulosus* (Plummer). It resembles *Rectoeponides cubensis* Cushman and Bermudez, described from the upper Eocene of Cuba, but it does not have the large number of rectilinear chambers. The aperture is indistinct in most of the specimens observed and is frequently broken off due to its location near the periphery. The internal tube mentioned by Plummer in the description of the genotype, *Coleites reticulosus* (Plummer), was not observed in this species. The periphery is slightly lobate in a majority of the specimens of *C. laevigatus*, and the peripheral flange is ragged in some of the specimens. It is common in both the Salt Mountain limestone and the Wilcox marl (Station 3), and also in the upper Midway limestone at Ft. Gaines, Georgia.

COLEITES RETICULOSUS (Plummer)
Plate 81, figure 21

Pulvinulina reticulosa PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 152, pl. 12, figs. 5 a, b. (Upper Midway, Texas.)

Coleites reticulosus PLUMMER, *1934*, Am. Mid. Nat., vol. 15, no. 5, p. 606, pl. 24, figs. 5–9. (Upper Midway, Texas.) CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 87, pl. 15, figs. 14–20. (Wilcox group, Woods Bluff, Alabama.) CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 71, pl. 12, fig. 20. (Midway group, Alabama.)

Four typically developed specimens of this Texas Midway species were found. They are broadly elongate, compressed, and the ventral side is more convex than the dorsal. The coiled portion of the dorsal and ventral surfaces is reticulate. The periphery is sharp. The species has been observed in the Bashi and Hatchetigbee formations of Alabama and the Vincentown formation of New Jersey. Length 0.64 mm.; width 0.52 mm. thickness 0.22 mm.

Hypotype.—Princeton University no. 52314.

Locality.—Station 2.

Family AMPHISTEGINIDAE
Genus ASTERIGERINA d'Orbigny, 1839
ASTERIGERINA cf. A. PRIMARIA Plummer
Plate 81, figure 22

Text subcircular in outline, about equally biconvex, periphery lobate, acute, with a flange; chambers about seven in number in the last whorl, supplementary chambers present on the ventral side but usually indistinct; dorsal sutures moderately curved, limbate, slightly elevated, merging into the peripheral flange, ventral sutures curved, slightly depressed; wall punctate; aperture an arched opening in the ventral face of the final chamber. Diameter up to 0.3 mm.; thickness 0.15 mm.

Depository.—Princeton University no. 52315.

Locality.—Station 2.

Remarks.—This species seems to be very close to the species Plummer (1927, p. 157) described from the Midway of Texas, but the Wilcox form has more chambers. The characters of the Salt Mountain specimens are not very distinct, and no specimens were found in the Wilcox marl. It is present in nearly all samples of the limestone, but is not a common species.

Family CHILOSTOMELLIDAE
Genus PULLENIA Parker and Jones, 1862
PULLENIA EOCENICA Cushman and Siegfus
Plate 81, figure 23

Pullenia eocenica CUSHMAN and SIEGFUS, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 31, pl. 7, figs. 1 a, b. (Eocene Kreyenhagen shale, California.)

Test planispiral, very slightly if at all compressed, completely involute, periphery very broadly rounded, somewhat lobate; chambers distinct, five in the last coil, gradually increasing in size as added; sutures distinct, very slightly if at all depressed, slightly curved; wall smooth, polished; aperture an elongate narrow opening extending across the periphery at the base of the low apertural face of the final

chamber. Diameter 0.63 mm.; thickness 0.5 mm.

Hypotype.—Princeton University no. 52316.

Locality.—Station 2.

Remarks.—This large tumid form of *Pullenia* is rare in the Salt Mountain limestone. It has not been observed in any other Wilcox formation in Alabama.

PULLENIA QUINQUELOBA (Reuss)
Plate 81, figure 24

Nonionina quinqueloba REUSS, *1851*, Zeit. deutsch. geol. Gesell., vol. 3, p. 71, pl. 5, fig. 31. (Oligocene, Germany.)

Pullenia quinqueloba CUSHMAN, *1924*, U. S. Nat. Mus. Bull. 104, pt. 5, p. 42, pl. 8, figs. 5–9, 11. (Recent, Atlantic Ocean.) PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 136, pl. 8, figs. 12 a, b. (Upper Midway, Texas.) NUTTALL, *1930*, Jour. Paleontology, vol. 4, p. 289. (Aragón, Chapapote, and Alazán formations, Mexico.) CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 72, pl. 12, figs. 13, 14. (Midway group, Alabama.)

Test planispiral, completely involute, bilaterally symmetrical, somewhat compressed, periphery rounded, slightly lobate; chambers four or five in the final whorl, increasing regularly in size as added; sutures distinct, straight, slightly depressed; wall smooth, polished; aperture a highly arched slit across the periphery at the base of the final chamber. Diameter 0.24–0.42 mm.; thickness up to 0.26 mm.

Hypotype.—Princeton University no. 52317.

Locality.—Station 2.

Remarks.—This species is common in the Salt Mountain limestone. It was not reported from the Wilcox at Ozark, or Woods Bluff, Alabama, but has been reported to occur rarely in the Wills Point formation (upper Midway group) in Texas. It occurs also in the Midway of Alabama. It is a widespread form and has a long range.

Family GLOBIGERINIDAE
Genus GLOBIGERINA d'Orbigny, 1826
GLOBIGERINA COMPRESSA Plummer
Plate 82, figures 1, 2

Globigerina compressa PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 135, pl. 8, figs. 11 a–c. (Upper Midway, Texas.) JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 193, pl. 31, fig. 8. (Hornerstown formation, New Jersey).

Test trochiform, moderately compressed, equally biconvex, periphery lobate, bluntly angular; chambers somewhat inflated, increasing regularly in size as added, five in the final whorl; sutures non-limbate, depressed, curved on the dorsal side, radiate on the ventral side; wall smooth; aperture an arched opening at the base of the septal face, extending from the periphery to the umbilical depression, shielded by a flap. Length up to 0.53 mm.; width up to 0.42 mm.; thickness up to 0.24 mm.

Hypotype.—Princeton University no. 52318.

Locality.—Station 2.

This very common Salt Mountain form has not been observed in any other Wilcox formation in Alabama. It is somewhat larger than the form from the Wills Point formation (Midway group) of Texas, but otherwise it is the same.

GLOBIGERINA TRILOCULINOIDES Plummer
Plate 82, figure 3

Globigerina triloculinoides PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 134, pl. 8, figs. 10 a–c. (Midway group, Texas.) JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 193, pl. 31, fig. 10. (Hornerstown formation, New Jersey.) GLAESSNER, *1937*, Moscow Univ. Publ. Lab. Paleontology, vols. II–III, p. 382, pl. 4, figs. 33 a, b. (Lower Tertiary, Caucasus.) CUSHMAN, *1940*, Cushman Lab. Foram. Research Contr., vol. 16, p. 72, pl. 12, fig. 15. (Midway group, Alabama.)

Test trochiform, made up of about two whorls, periphery lobate, very broadly rounded; chambers globose, rapidly increasing in size as added, the last three chambers making up nearly the whole test, last whorl made up of about 3½ chambers, preceding whorl of small chambers slightly elevated and forming a very low spire on the dorsal side of test, ventral side of test with umbilical depression; sutures much depressed; wall strongly reticulate; aperture an arched opening in the final chamber, shielded by a short flap. Length 0.4 mm.; width 0.3 mm.

Hypotype.—Princeton University no. 52319.

Locality.—Station 2.

Remarks.—*G. triloculinoides* is common and well preserved in the Salt Mountain limestone and in the Wilcox marl bed at Station 3. It was not reported from the Wil-

cox at Ozark, Alabama. It is common in an outcrop of the Bashi formation in a road cut on the Camden-Monroeville road, 20 miles south of Camden, Alabama, and is rare in the Hatchetigbee formation. Jennings (1936, p. 193) says that it is rare in the Hornerstown formation of New Jersey. It is common in the Vincentown limesand of New Jersey. The California Eocene specimen figured by Israelsky (1939, p. 579, pl. 7, fig. 5) as *G. topilensis* more closely resembles this species than it does the original figure of *G. topilensis* Cushman.

Family GLOBOROTALIIDAE
Genus GLOBOROTALIA Cushman, 1927
GLOBOROTALIA MEMBRANACEA (Ehrenberg)
Plate 82, figures 4, 5

Planulina membranacea EHRENBERG, *1854*, Mikrogeologie, pl. 25, 1A, [not fig. 41] pl. 26, fig. 43.

Pulvinulina membranacea CUSHMAN, *1926*, Am. Assoc. Petroleum Geologists Bull., vol. 10, no. 6, p. 608, pl. 21, figs. 10 a, b. (Velasco shale, Mexico.)

Globorotalia membranacea M. P. WHITE, *1928*, Jour. Paleontology, vol. 2, p. 280, pl. 38, figs. 1 a–c. (Velasco shale, Mexico.)

Test trochiform, moderately compressed, biconvex, longer than broad, periphery lobate, acute, carinate; chambers distinct, inflated on the ventral side only, five or six in number in the last whorl, increasing regularly in size as added, small chambers of preceding whorl forming a very low spire on the dorsal side of the test, ventral side with small umbilical depression; sutures on the dorsal side curved, limbate and flush with the surface, joining with the peripheral carina, ventral sutures depressed, nearly radiate; wall smooth, polished; aperture an arched opening at the base of the septal face, extending from the periphery to the umbilicus. Length up to 0.44 mm.; width up to 0.35 mm.; thickness up to 0.19 mm.

Hypotype.—Princeton University no. 52320.

Locality.—Station 2.

Remarks.—This species is common in the Salt Mountain limestone and in the Wilcox marl at Station 3. It is identical with the form occurring in the Velasco shale in Mexico. It has not been reported from the Midway or Wilcox groups in the Gulf Coastal Plain heretofore.

GLOBOROTALIA WILCOXENSIS Cushman and Ponton
var. ACUTA Toulmin, n. var.
Plate 82, figures 6–8

Test trochiform, plano-convex, dorsal side flat, ventral side strongly convex, deeply umbilicate, periphery strongly lobate, acute, and bounded by a thick flange; chambers distinct, about 4½ in the last whorl, increasint regularly in size as added; sutures distinct, on the dorsal side slightly curved, limbate, slightly if at all depressed, on the ventral side radiate, depressed; wall roughened with minute, low spinose processes, especially along the peripheral border; aperture an arched opening on the ventral side of the final chamber extending from the peripheral flange to the umbilicus. Length 0.46 mm.; width 0.37 mm.; thickness 0.24 mm.

Holotype.—Princeton University no. 52321.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—This variety is common in the Salt Mountain limestone. The chambers of this variety on the ventral side are not so broadly inflated as those of the Ozark species, but rise to narrowly rounded or almost angled apexes around the deep umbilicus, and the peripheral angle is carinate. *G. wilcoxensis* var. *acuta* resembles *G. velascoensis* (Cushman), but differs from that species in having only four or five chambers in the final whorl instead of seven, and the sutures are not beaded in the Alabama variety.

Family ANOMALINIDAE
Genus ANOMALINA d'Orbigny, 1826
ANOMALINA ACUTA Plummer
Plate 82, figures 9, 10

Anomalina ammonoides var. *acuta*, PLUMMER, *1927*, Univ. Texas Bull. 2644, p. 149, pl. 10, figs. 2 a–c. (Midway group, Texas.)

Anomalina acuta GLAESSNER, *1937*, Moscow Univ., Publ. Lab. Paleontology, vols. II–III, p. 386, taf. 5, figs. 39 a–c. (Lower Tertiary, Caucasus.)

Test compressed, biconvex, subcircular in outline, periphery subacute; chambers numerous, about 13 or 14 in the last whorl, narrow; dorsal sutures distinct, curved, limbate in the earlier portion of the whorl,

simple and slightly depressed in the later portion, ventral sutures broadly and bluntly thickened around the umbilical boss but separated from it; wall coarsely perforate; umbilical region partly filled with a sharply elevated clear boss; dorsal surface with smooth and gently convex umbonal boss of clear shell material; aperture an arched slit extending across the periphery toward the umbilicus on the ventral side. Diameter up to 0.4 mm.; thickness up to 0.19 mm.

Hypotype.—Princeton University no. 52322

Locality.—Station 2.

Remarks.—This is a common species in both the Salt Mountain limestone and Wilcox marl (Station 3). It was first described from the Midway of Texas where it was said to be common in both the Kincaid formation (lower Midway) and the Wills Point formation (upper Midway). It is present in the Midway group and in the Nanafalia formation in Alabama. A very similar form with about 10 chambers and a less acute peripheral angle is present in the Tuscahoma, Bashi and Hatchetigbee formations of Alabama. It was referred to *Cibicides* sp. by Cushman and Garrett (1939, p. 88).

CIBICIDES BLANPIEDI Toulmin, n. sp.
Plate 82, figures 11–13

Test subcircular, plano-convex, non-lobate, with acute peripheral angle; dorsal side flat, somewhat evolute, the final whorl of chambers partially embracing the preceding whorl; ventral side very convex, subconical, involute; chambers distinct, eight or nine in the final whorl, on the dorsal side curved and uninflated, on the ventral side curved and strongly produced ventrally, with the ventral end of each chamber extending beyond that of the preceding; sutures on the dorsal side distinct, flush with the surface, moderately curved, somewhat limbate in the early portion of the test but becoming non-limbate in the latest portion, sutures on the ventral side distinct, flush with the surface, somewhat sigmoid; wall smooth, very finely perforate, polished; aperture a slit on the dorsal side at the inner margin of the last two or three chambers, arching across the periphery. Diameter up to 0.31 mm.; height up to 0.22 mm.

Holotype.—Princeton University no. 52325.

Locality.—Station 2.

Remarks.—This species is very similar to *Cibicides westi* Howe from the Cook Mountain Eocene of Louisiana but differs from it in that the dorsal coils are less evolute, the periphery is non-lobate, and the ventral sutures are not depressed. It is very abundant in the Salt Mountain limestone and is rare in the Wilcox marl (Station 3). It has not been observed in any other formation except the Nanafalia.

Genus CIBICIDES Montfort, 1808
CIBICIDES BURLINGTONENSIS Jennings
Plate 82, figures 14, 15

Cibicides burlingtonensis JENNINGS, *1936*, Bull. Am. Paleontology, vol. 23, p. 197, pl. 32, figs. 5 a–c. (Hornerstown formation, New Jersey.)

Test plano-convex, dorsal side flat, ventral side convex, periphery bluntly angled and lobate; chambers seven or eight in the mature whorl, expanding rather rapidly in size, final chamber usually broadly expanded; sutures curved, limbate, frequently somewhat raised in the earlier part of the final whorl and becoming less limbate and depressed in the later part; wall coarsely perforate; aperture an arched slit extending across the periphery to the dorsal side along the base of the final chamber. Length up to 0.85 mm.; width up to 0.66 mm.; thickness up to 0.31 mm.

Hypotype.—Princeton University no. 52323.

Locality.—Station 2.

Remarks.—This common Salt Mountain limestone species is the same as the one described and figured by Jennings from the Hornerstown of New Jersey. The same species is also very common in the Vincentown limesand. It is very common in the Sucarnoochee clay of Alabama.

CIBICIDES HOWELLI Toulmin, n. sp.
Plate 82, figures 16–18

Cibicides cf. *pseudoungerianus* CUSHMAN and GARRETT, *1939*, Contr. Cushman Lab. Foram. Res., vol. 15, p. 88, pl. 15, figs. 25, 26. (Wilcox group, Woods Bluff, Alabama.)

Test plano-convex, subcircular in outline, earlier whorls on dorsal surface obscured by

growth of shell material, ventral surface very convex, almost conical, capped by an elevated, low, rounded, smooth umbonal boss of clear to translucent shell material, periphery narrowly angled in the early portion of the last whorl, becoming bluntly angled or rounded in the later portion; chambers 9 or 10 in number in the final whorl, increasing gradually in size as added; dorsal sutures moderately curved, ventral sutures more gently curved than the dorsal, early sutures on dorsal and ventral sides flush with the surface, later sutures slightly depressed; wall coarsely perforate; aperture a slit-like opening at the base of the final chamber, arching across the periphery and extending onto the dorsal side. Length up to 0.55 mm.; width up to 0.42 mm.; thickness up to 0.24 mm.

Holotype.—Princeton University no. 52324.

Locality.—Salt Mountain limestone from Richmond Branch, half a mile north of Salt Mountain. Station 2.

Remarks.—This species is very common in the Salt Mountain limestone and in the Wilcox marl just above the limestone, and is present in the Nanafalia, Tuscahoma, Bashi, and Hatchetigbee formations, but is not present in the Wilcox at Ozark, Alabama. The same species is common in the Vincentown limesand of New Jersey. It differs from *C. burlingtonensis* Jennings in that the chambers of the final whorl increase regularly in size, and the final chamber is not so broadly expanded. *C. howelli* differs fron *C. pseudoungerianus* (Cushman) and the larger *C. mortoni* (Reuss) in being plano-convex instead of biconvex. It is larger than the similar *C. praecursoria* var. *umbonifera* (Schwager), and the dorsal sutures are more strongly curved.

CIBICIDES PRAECURSORIUS (Schwager)
Plate 82, figures 19–21

Discorbina praecursoria SCHWAGER, *1883*, Palaeontographica, vol. 30, Pal. Theil, p. 125, pl. 27 (4), figs. 12 a–d, 13 a–d; pl. 29 (6), figs. 16 a–d. (Eocene, Egypt.)

Cibicides praecursorius CUSHMAN and PONTON, *1932*, Cushman Lab. Foram. Research Contr., vol. 8, p. 72, pl. 9, figs. 14 a–c. (Wilcox group, Ozark, Alabama.) CUSHMAN and GARRETT, *1939*, Cushman Lab. Foram. Research Contr., vol. 15, p. 88. (Wilcox group, Woods Bluff, Alabama.)

Test trochiform, plano-convex, dorsal side flat or nearly flat, ventral side moderately convex; periphery acute, slightly lobate; chambers distinct, seven to nine in the final whorl, slightly inflated on both sides in the later part of the whorl, increasing regularly in size as added, of uniform moderately curved shape; sutures distinct, slightly depressed on the dorsal side, more deeply depressed on the ventral side and radiating from a low small umbo, rather strongly curved on dorsal side, slightly curved on ventral side; wall smooth, rather finely perforate, polished; aperture a low slit at base of final chamber on the ventral side, arching across the periphery onto the dorsal side where it extends along the base of the last two chambers. Length 0.37 mm.; width 0.33 mm.; thickness 0.16 mm.

Hypotype.—Princeton University no. 52326.

Locality.—Station 2.

Remarks.—This species is frequent but not common in the Salt Mountain limestone at Station 2 and in the Wilcox marl bed at Station 3. It is present in the Midway group and in the Tuscahoma, Bashi, and Hatchetigbee formations in Alabama. It differs from *C. relizensis* Kleinpell in having curved sutures on the ventral side and a small umbo of clear material. On the dorsal side two coils are distinctly visible. It differs from *C. cushmani* Nuttall in having seven to nine chambers instead of 10, and in having a filled instead of depressed umbilical region on the ventral side. *C. cushmani* was also described as having limbate sutures of clear shell material on the dorsal side. It resembles the larger form, *C. pseudowuellorstorfi* Cole, from the Guayabal formation of Mexico, but it has fewer chambers and the dorsal sutures are not limbate.

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THE OSTRACODE GENUS CYTHERELLOIDEA FROM THE TERTIARY OF THE NETHERLANDS EAST INDIES

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ABSTRACT—Fourteen new species and one variety of the ostracode genus *Cytherelloidea* from the middle and late Tertiary of the Netherlands East Indies are figured and described in this paper.

THE GENUS *Cytherelloidea*, erected in 1929 by Alexander (1929) in his studies of the Ostracoda of the Gulf Coast Tertiary of the United States, has not been previously recorded from the East Indian Archipelago. Doeglas (1931) figured and described an ostracode fauna from the Tertiary of northeast Borneo. His paper was devoted primarily to the genera *Bairdia* (*Nesidea*), *Cythereis*, *Bythocypris* and *Cytheropteron*.

As a general rule, *Cytherelloidea* is found sparingly in the Tertiary sediments of the Netherlands East Indies. The number of species, as well as individuals, is small. Before placing an index value on the recorded species, much more remains to be done in determining their stratigraphical range, frequency and regional distribution.

The group recorded in this paper is represented by three species (*C. sangkoelirangensis*, *C. indica*, *C. orientalis*) from the late Tertiary (tentatively assigned to late Miocene by the author), marls of the Sangkoelirang Bay area of East Borneo (near the intersection of latitude 1° 00′ north and longitude 118° 00′ east), four species (*C. javana*, *C. soendaensis*, *C. bantamensis*, *C. bodjongensis*) from the Miocene and Pliocene of the Bantam Residency, West Java (within area bounded by latitudes 6° 00′ and 6° 30′ south and longitudes 106° 00′ and 106° 30′ east) and seven species and one variety (*C. baganensis*, *C. javana var. rokanensis*, *C. malayaensis*, *C. nabaraensis*, *C. malaccaensis*, *C. bangkoensis*, *C. sumatrensis*, *C. nomlandi*) from the Miocene of the lower Rokan River area of central Sumatra (within area bounded by latitudes 1° 30′ and 2° 15′ north and longitudes 99° 50′ and 101° 30′ east).

There appears to be little in common between the East Indian forms and figures and descriptions of species of the genus from the Eocene and Oliogocene of the Gulf Coast region of the United States as recorded by Howe (1934, 1935, 1936) and Alexander (1929).

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Holotypes, cotypes and paratypes of the described species have been deposited in the Netherlands Government Geological Museum at Bandoeng, Java. Paratypes of a number of species are on file in the Paleontological Laboratory of the Colorado School of Mines, Golden, Colorado, and in the collections of the Louisiana State University, Baton Rouge.

SYSTEMATIC DESCRIPTIONS

Order OSTRACODA Latreille
Suborder PLATYCOPA Sars
Family CYTHERELLIDAE

Genus CYTHERELLOIDEA Alexander, 1929

The carapace in the genus *Cytherelloidea* is elongate, subovate, or oblong-ovate in side view, and is, as a general rule, more compressed anteriorly than posteriorly. The wall may vary considerably in thickness. Dorsal and ventral margins may be straight, curved,

or slightly depressed. The right valve is larger than the left and overlaps it conspicuously along the ventral and dorsal margins. The left valve fits into a distinct groove lying inside the outer margin of the right valve. Hinge teeth are absent.

The muscle scar pattern is characteristic of the genus *Cytherella*, which is described by Alexander (1934, p. 209), as lying slightly above and in front of the center of the valves. It is oval or elliptical, and its long axis is almost at right angles to that of the shell, the upper end of the axis being slightly nearer the anterior end of the shell than the lower end. Along each side of the longitudinal axis is a row of narrow muscle scars.

The surface of the valves is characterized by various ridges and divides; an inner marginal rim extends completely or partially around the valve; just above the median line and near middle lies a subcentral pit area which may vary considerably in size and shape.

CYTHERELLOIDEA MALAYAENSIS
LeRoy, n. sp.
Plate 83, figures 1, 2

Carapace elongate in side view, thin-shelled, about twice as long as high. Dorsal margin nearly straight in right valve, slightly depressed just anterior to middle in left valve, sloping more abruptly anteriorly than posteriorly near dorsal angles. Ventral margin straight to slightly convex downward. Ventral angles broadly rounded. Anterior and posterior extremities broadly rounded, posterior slightly more oblique than anterior. Surface ornamentation of both valves nearly identical. Subcentral pit area well defined; circumscribed by a well-developed, rounded ridge which shows its greatest height and width along the ventral border. The pit area ranges in outline from circular to subcircular; it is usually divided into two unequal portions, with the posterior part being the larger. Beginning at the low posterior part of the circular subcentral pit area, a ridge extends backward for a short distance and then turns suddenly downward and continues inside and parallel to the outer posterior and ventral margins to a point just above the anterior ventral angle, where it merges with the anterior surface. A conspicuous, elongate, slightly downwardly curved, depressed area, which is interrupted by frequent small divides, exists between the ventral inner marginal ridge and the ventral portion of the subcentral pit ridge. Dimensions of holotype: (fig. 1, left valve), length 0.45 mm., height 0.28 mm.; (fig. 2, right valve), length 0.45 mm., height 0.30 mm.

Type.—Holotype, Bandoeng Museum Coll. no. P.S. 1120; paratype, Colorado School of Mines Coll. no. 1500.

Locality.—N-5500. Eleven kilometers S. 20° W. from Kampoeng Doemai. Sultanate of Siak. East coast of Sumatra. Netherlands Government Topographic Blad 20/XIV. Miocene.

Remarks.—This species is somewhat related to *Cytherelloidea malaccaensis* LeRoy but differs from it primarily by the inner ventral marginal rim extending upward and connecting the posterior part of the subcentral pit ridge. It is also more elongate.

Some Foraminifera frequently associated with this species are: *Textularia malaccaensis* LeRoy, *Elphidium koeboeense* LeRoy, *Cibicides rokanensis* LeRoy, *Cibicides tapanoeliensis* LeRoy.

CYTHERELLOIDEA NABARAENSIS
LeRoy, n. sp.
Plate 83, figures 3, 4

Carapace oblong-ovate in side view, thickest and highest posteriorly. Dorsal and ventral margins straight to slightly depressed near middle, converging slightly toward anterior end. Anterior and posterior extremities broadly rounded, slightly more rounded posteriorly. A low, broad, indistinct inner marginal rim begins near the posterior dorsal angle and continues around the valve reaching its best development along the posterior, ventral and anterior margins. The subcentral pit area is encompassed by a broad rounded ridge, which is conspicuously developed along the ventral border of the area. The lower part of the posterior portion of the pit ridge is connected by a short ridge to the high part of the posterior inner marginal rim. A short ridge extends anteriorly from the low anterior part of the pit ridge but dies out before reaching the anterior inner marginal rim. Dimensions of holotype, length 0.50 mm., height 0.35 mm., thickness 0.27 mm.

Type.—Holotype, Bandoeng Museum Coll., no. P.S. 1118.

Locality.—BR(VB)-67. 8.6 kilometers S. 32° E. of Tr. St. 1460 or 20 kilometers S. 52° E. of Rantau Prapat, east coast Sumatra, Netherlands Government Topographic Blad 41, 1:100,000, east coast Sumatra, Miocene.

Remarks.—This species exhibits only the more broad, smooth surface ornamentation. Small intermediate divides and ridges are lacking.

Some common Foraminifera associated with this species include: *Cibicides telisaensis* LeRoy, *Cibicides tapanoeliensis* LeRoy, *Globigerina* spp., *Bolivina gemma* Cushman, *Uvigerina soendaensis* LeRoy, *Bolivina alata* (Seguenza), *Baggina inflata* LeRoy, *Uvigerina multicostata* LeRoy.

Cytherelloidea malaccaensis LeRoy, n. sp.
Plate 83, figures 5, 6

Carapace elongate-ovate in side view, thickest posterior to middle and slightly below median line. Dorsal and ventral margins slightly curved. Anterior and posterior ends broadly rounded. A ventral inner marginal rim begins inside and near the middle of the anterior margin and extends backward at a moderate distance from the ventral margin to terminate in the lower posterior portion of the valve before reaching the outer posterior margin and the median line. A broad central ridge merges from the anterior surface and circumscribes the subcentral pit area, which is divided into two unequal parts. The posterior part is the larger of the two. Four to five short secondary divides connect the ventral ridge of the pit area to the inner ventral marginal rim. Dimensions of holotype (fig. 5), length 0.40 mm., height 0.27 mm.; paratype (fig. 6), length 0.43 mm., height 0.27 mm.

Types.—Holotype, Bandoeng Museum Coll. no. P.S. 1119. Paratype, Colorado School of Mines Coll. no. 1509.

Locality.—WA-376. 25 kilometers north of Teloek Poelau, situated on the east bank of the Rokan River, 4 kilometers upstream from the confluence of the Bangko River. Netherlands Government Topographic Blad 19/XIII, East Coast of Sumatra. Miocene.

Remarks.—This species is distinctive in its characters. It is somewhat related to *Cytherelloidea malayaensis* LeRoy, but differs primarily in the posterior trend of the ventral inner marginal rim. This form occasionally has been noted in sediments lying below *Katacycloclypeus annulatus* (Martin) in the Bantam area, west Java.

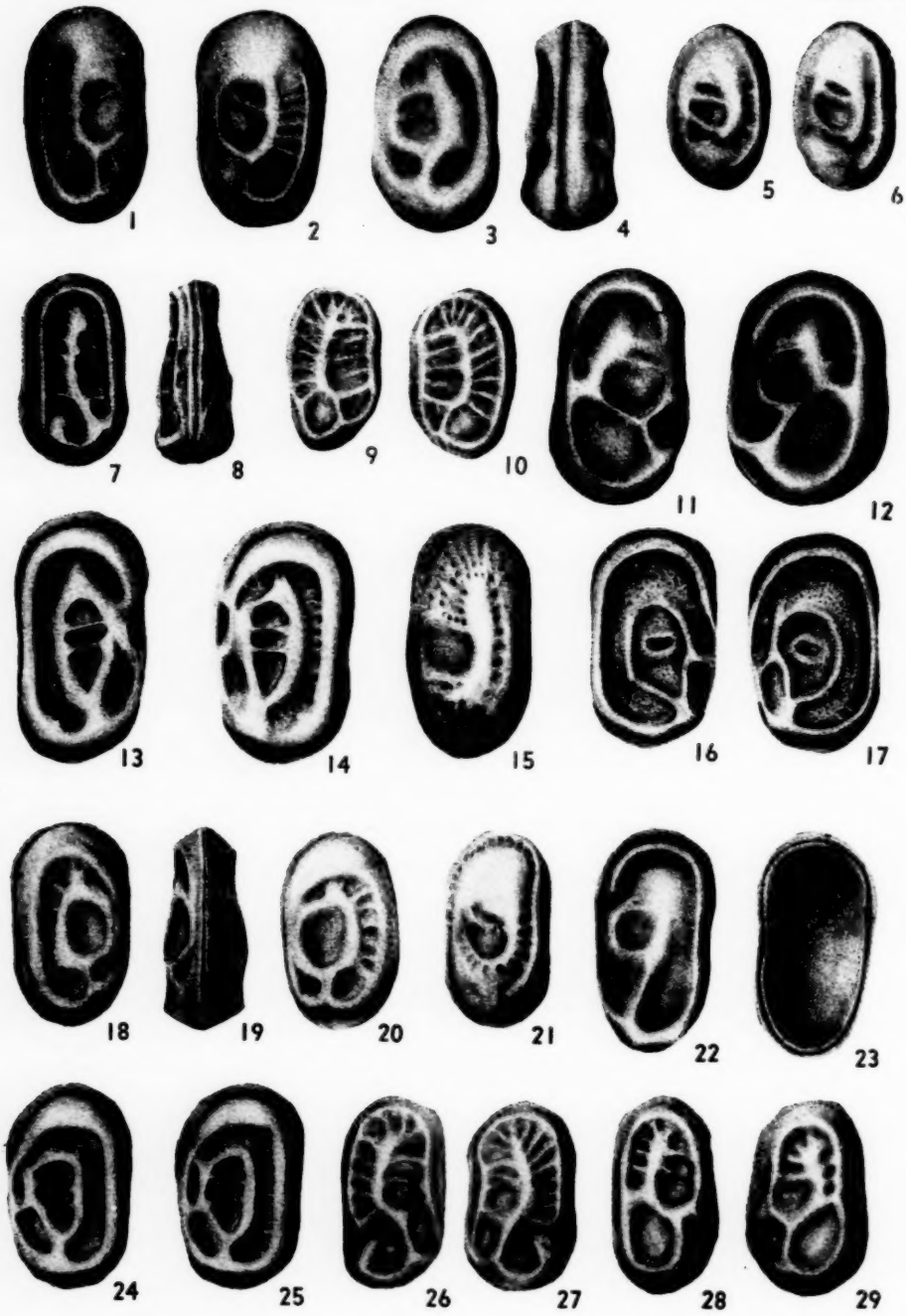
Cytherelloidea javana LeRoy, n. sp.
Plate 83, figures 7, 8

Carapace in side view oblong-ovate, heavy-walled, thickest posterior to middle, height three-fifths length. Dorsal and ventral margins parallel, both slightly depressed near middle. Anterior and posterior ends broadly and nearly equally rounded. A well-defined inner marginal rim begins just below the posterior dorsal angle, continues along the dorsal margin, around the anterior margin and back along the ventral margin and dies out just above the posterior ventral angle. A broad slightly curved ridge starting anteriorly and not connected with the inner marginal rim extends medianly to a point just posterior to middle, then curves gently upward toward the high posterior margin, where it is connected to a short broad ridge, thence curves back downward and around to a point just above the termination of the ventral inner marginal rim. Here it forms a moderately developed node. Several minor divides connect the median ridge with the dorsal and ventral inner marginal rim. The subcentral pit area, roughly quadrangular in outline and surrounded by a low bordering ridge, is developed better on the right valve than on the left. Dimensions of holotype, length 0.50 mm., height 0.30 mm., thickness 0.23 mm.

Holotype.—Bandoeng Museum Coll. no. P.S. 1112.

Locality.—L-24. Exposure along the south bank of the Tjidoerian River just east of Djasinga, Bantam Residency, west Java. Miocene.

Remarks.—This species is easily recognized by the general shape of the median ridge, which is in the form of an inverted question mark. Occasionally this species has been noted from the Pliocene deposits of west Java. A variety (*Cytherelloidea javana* var. *rokanensis* LeRoy) of this species is recorded from the Miocene of central Sumatra.



Le Roy, Tertiary Ostracoda

UNIV. OF MICH.

CYTHERELLOIDEA JAVANA LeROY, var. ROKANENSIS LeROY, n. var.
Plate 83, figures 26, 27

This variety differs from the original by being less elongate and by showing a slightly narrower marginal rim and a better development of the subcentral pit area. The median ridge also exhibits more upward curvature than is shown by *Cytherelloidea javana* LeRoy. Dimensions of holotype (fig. 26, left valve), length 0.45 mm, height 0.27 mm.; (fig. 27, right valve), length 0.45 mm., height 0.30 mm.

Types.—Holotype, Bandoeng Museum Coll. no P.S. 1116. Paratype, Colorado School of Mines Coll. no. 1507.

Locality.—WA-376, 25 kilometers north of Teloek Poelau, situated on the east bank of the Rokan River, 4 kilometers upstream from the confluence of the Bangkor River, east coast of Sumatra, Netherlands Government Topographic Blad 19/XIII. Miocene.

Remarks.—This variety is frequently found in the Miocene sediments of the east coastal plain region of central Sumatra.

CYTHERELLOIDEA BANGKOENSIS LeROY, n. sp.
Plate 83, figures 9, 10

Carapace elongate, valves flat. Dorsal margin slightly depressed near middle. Ventral margin faintly convex downward. Anterior end of right valve broadly rounded; posterior end slightly oblique. Posterior and anterior ends of left valve obliquely rounded. showing sharpest curvature at the ventral angles. A narrow elevated marginal rim of the left valve begins just below the anterior dorsal angle and continues along and slightly inside the dorsal margin. At the posterior dorsal angle, it turns downward toward the posterior ventral angle at the same time diverging from the outer posterior margin. From the posterior ventral angle the rim continues forward for a short distance just inside the ventral margin and then merges with the outer margin and continues around the anterior extremity until the circuit is completed at the anterior dorsal angle. On the right valve, this rim lies inside and approximately parallels the outer margins. Its

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EXPLANATION OF PLATE 83

FIGS. *1, 2—Cytherelloidea malayaensis* LeRoy, n. sp. ×67. *1*, left valve; *2*, right valve. Holotype. (p. 613)

3, 4—Cytherelloidea nabaraensis LeRoy, n. sp. ×59. *3*, Right valve; *4*, dorsal view. Holotype. (p. 613)

5, 6—Cytherelloidea malaccaensis LeRoy, n. sp. ×57. Right valves. *5*, Holotype; *6*, Paratype (p. 614)

7, 8—Cytherelloidea javana LeRoy, n. sp. ×52. *7*, Left valve; *8*, dorsal view. Holotype. (p. 614)

9, 10—Cytherelloidea bangkoensis LeRoy, n. sp. ×57. *9*, Left valve; *10*, right valve. Holotype. (p. 615)

11, 12—Cytherelloidea soendaensis LeRoy, n. sp. ×64. *11*, Left valve; *12*, right valve, Holotype. (p. 616)

13, 14—Cytherelloidea sangkoelirangensis LeRoy, n. sp. ×57. *13*, Left valve; *14*, right valve. Holotype. (p. 616)

15—Cytherelloidea bantamensis LeRoy, n. sp. ×59. Right valve. Syntype. (p. 617)

16, 17—Cytherelloidea indica LeRoy, n. sp. ×55. *16*, Left valve; *17*, right valve. Holotype. (p. 618)

18–20—Cytherelloidea sumatrensis LeRoy, n. sp. ×55. *18*, Left valve; *19*, dorsal view; *20*, right valve; *18–19*, holotype; *20*, paratype. (p. 618)

21—Cytherelloidea bodjongensis LeRoy, n. sp. ×60. Right valve. Syntype. (p. 619)

22, 23—Cytherelloidea nomlandi LeRoy, n. sp. ×67. *22*, Right valve; *23*, inside view of right valve. Syntype. (p. 619)

24, 25—Cytherelloidea orientalis LeRoy, n. sp. ×54. Right valves. *24*, Holotype; *25*, paratype. (p. 620)

26, 27—Cytherelloidea javana LeRoy, var. *rokanensis* LeRoy, n. var. ×58, *26*, Left valve; *27*, right valve. Holotype. (p. 615)

28, 29—Cytherelloidea baganensis LeRoy, n. sp. ×63. *28*, Left valve; *29*, right valve. Holotype. (p. 620)

highest elevation is reached along the ventral portion. The subcentral pit area, rectilinear to subcircular in outline and divided into several parts by minor transverse ridges, is completely circumscribed by a narrow ridge, which is slightly arched downward along the ventral border of the area. A small ridge connects the upper part of the posterior inner marginal rim to the lower posterior part of the pit area. Several secondary ridges branch forward from the lower anterior part of the pit area and connect the anterior inner marginal rim at several points. The ventral part of the pit area is connected to the ventral inner marginal rim by four or five secondary divides. Dimensions of holotype (fig. 9, left valve), length 0.40 mm., height 0.25 mm.; (fig. 10, right valve), length 0.40 mm., height 0.27 mm.

Type.—Holotype, Bandoeng Museum Coll. no. P.S. 1114. Paratype, Colorado School of Mines Coll. no. 1501.

Locality.—WA-376, 25 kilometers north of Teloek Poelau, situated on the east bank of the Rokan River, 4 kilometers upstream from the confluence of the Bangko River, East Coast of Sumatra, Netherlands Government Topographic Blad 19/XIII. Miocene.

Remarks.—This species shows a very distinct and characteristic surface sculpturing, which remains remarkably uniform. It may be recognized by the frequent secondary ridges connecting the median ridge with the inner marginal rim, and by its completely closed inner marginal rim. The surface ridges as a general rule are comparatively narrow and sharp. The high ridge bordering the ventral margin of the subcentral pit area is an outstanding feature in the surface pattern.

This species has been sparingly noted below *Katacycloclypeus annulatus* (Martin) in the Bantam area, west Java.

Cytherelloidea soendaensis
LeRoy, n. sp.
Plate 83, figures 11, 12

Carapace elongate in side view, heavy-shelled, surface strongly and deeply sculptured. The right valve is conspicuously larger than the left. Dorsal and ventral margins of right valve straight, slightly divergent toward anterior. Dorsal and ventral margins of left valve both somewhat depressed near middle. Anterior and posterior extremities very broadly and rather uniformly rounded. A high marginal rim begins just below or at the posterior dorsal angle, extends around and just inside the posterior, ventral and anterior margins and dies out just below the anterior dorsal angle. This rim is extremely well developed. It is quite high and relatively broad at the base. The subcentral area is quite conspicuous and is irregularly circumscribed by a ridge of variable height and width, which connects the inner marginal rim by short ridges at two points; one near the middle of the inner ventral marginal rim and the other at the high part of the posterior marginal rim just below the posterior dorsal angle. The ridge bordering the ventral part of the subcentral pit area forms a rather sharp angle near the middle. In the lower half of the posterior portion of the valve, a large, somewhat semicircular depression is present. Dimensions of holotype (fig. 11, left valve), length 0.50 mm., height 0.30 mm.; (fig. 12, right valve) length 0.50 mm., height 0.35 mm.

Types.—Holotype, Bandoeng Museum Coll. no. P.S. 1121. Paratype, Colorado School of Mines Coll. no. 1502.

Locality.—From Sakelat No. 1 well (N.P.P.M.). Depth 860 feet. Near Djasinga, west Java.

Remarks.—This species is rarely encountered. It may be recognized by its irregular development of surface sculpturing. The species is similar to *Cytherelloidea baganensis* LeRoy with respect to the large depressed area in the lower posterior part of the valve.

Cytherelloidea sangkoelirangensis
LeRoy, n. sp.
Plate 83, figures 13, 14

Carapace elongate in side view, heavy-shelled, surface sculpture in strong relief and well-developed. Dorsal margin straight to slightly arched. Ventral margin faintly depressed near middle. Anterior and posterior ends broadly rounded, about equal in left valve, but in right valve the anterior extremity is rounded more broadly than the posterior. The ornamentation of both the right and left valves is approximately identi-

cal except for minor variations along the dorsal margin. The valves show a heavy, broadly rounded inner marginal rim starting just below the anterior dorsal angle and continuing around the anterior, ventral and posterior margins at a moderate distance inside the outer margin, finally merging with the dorsal margin near the posterior dorsal angle. Just below the posterior dorsal angle and connecting the upper part of the posterior inner marginal rim a short thick ridge extends forward into two branches. These branches bound the elongate subcentral pit area and merge again in the anterior half to form a single ridge which dies out just before reaching the anterior inner marginal rim. On the dorsal side of the pit area, the ridge is connected to the dorsal margin by a small downwardly curved ridge, whose extremities are located just anterior and posterior to middle. The subcentral pit area is divided into three parts by two narrow, low transverse divides oriented approximately normal to the median line. The area lying between the ventral inner marginal rim and the ridge bordering the ventral portion of the subcentral pit area contains many small evenly spaced divides. Dimensions of holotype (fig. 13, left valve), length 0.60 mm., height 0.35 mm. (fig. 14, right valve), length 0.60 mm., height 0.40 mm.

Types.—Holotype, Bandoeng Museum Coll. no. P.S. 1108. Paratype, Colorado School of Mines Coll. no. 1503.

Locality.—E-13. Sangkoelirang Bay, east coast of Borneo. west shore of P. Singkoewang and 1½ kilometers northwest of Sangkoelirang. Miocene.

Remarks.—This species varies from *Cytherelloidea orientalis* LeRoy by being larger, more robust, by showing a heavier surface ornamentation, and by showing an extended ridge at the anterior end of the pit area.

Associated Foraminifera include: *Bolivinita quadrilatera* (Schwager), *Ceratobulimina pacifica* Cushman and Harris, *Cibicides dorsopustulosus* LeRoy, *Globorotalia menardii* (d'Orbigny), *G. tumida* (Brady), *Orbulina universa* d'Orbigny, *Pulleniatina obliquiloculata* (Parker and Jones), *Pleurostomella alternans* Schwager, *Siphogenerina raphanus* (Parker and Jones), *Textularia porrecta* (Brady), *Uvigerina schwageri* Brady.

CYTHERELLOIDEA BANTAMENSIS
LeRoy, n. sp.
Plate 83, figure 15

Carapace elongate, thin-shelled, semitransparent. Dorsal and ventral margins straight, parallel. Anterior and posterior ends broadly rounded, anterior slightly more rounded than posterior. Marginal rim absence with exception of a slight reflection along the dorsal margin. A broad, rounded, low, slightly downwardly curved median ridge begins just below the posterior dorsal angle and extends to a point just below the anterior dorsal angle, where it branches into numerous faintly reflected ridges that die out and merge with the surface of the valve before reaching the outer anterior margin. These branching ridges are connected by smaller divides, which give the anterior quarter a pitted appearance. Lying immediately below and parallel to the median ridge and along the ventro-lateral edge of the valve, there is another curved low, broad longitudinal ridge, which dies out before reaching the anterior and posterior margins. This ridge is much narrower than the median ridge and is connected to it by eight to ten short divides. The subcentral pit area is located just posterior to middle. The posterior and anterior margins of this area are bordered by slight elevations. The dorsal part is open and merges with the dorsal surface. The ventral part is bordered by the median ridge. Dimensions of syntype, length 0.55 mm., height 0.30 mm.

Type.—Syntype, Bandoeng Museum Coll. no. P.S. 1115.

Locality.—L-3. Road cut 3½ kilometers south of Kampoeng Bodjong, between kilometer posts 31 and 32 on Pandaglang-Malingping road, Bantam Residency, west Java. Bantamien Pliocene.

Remarks.—This species is conspicuous for its poor development of surface sculpture. The broad median ridge, which branches anteriorly, and the underlying narrow ventrolateral ridge establishes its identity.

Foraminifera associated with this species include: *Cancris auriculus* (Fichtel and Moll), *Cribrolinoides curta* (Cushman), *Nonion boueanus* (d'Orbigny), *Orbulina universa* d'Orbigny, *Quinqueloculina cuvieriana* d'Orbigny, *Q. boueana* d'Orbigny, *Textularia*

haueri d'Orbigny, *Triloculina tricarinata* d'Orbigny, *Discorbis bodjongensis* LeRoy (MS).

CYTHERELLOIDEA INDICA LeRoy, n. sp.
Plate 83, figures 16, 17

Carapace elongate-ovate in side view, about two-thirds as high as long, thickest medianly and near middle. Dorsal margin slightly arched. Ventral margin nearly straight, but faintly depressed near middle. Anterior and posterior ends broadly rounded. The right valve shows a sharp-crested inner marginal rim extending around the entire periphery of the valve. This rim tends to coincide with the outer margin along the posterior half of the dorsal margin and along the ventral margin just posterior to middle. At the anterior and posterior ends, it lies at a considerable distance from the outer margin. The inner marginal rim on the left valve begins just below the posterior dorsal angle and continues at a moderate distance from the outer margin around the posterior, ventral, and anterior margins, then terminates and merges with the dorsal margin just anterior to middle. Just below the posterior dorsal angle and connecting the high portion of the inner marginal rim, a short ridge extends forward, branches and irregularly circumscribes the subcentral pit area. The elliptically shaped pit, with its longer axis approximately normal to the median axis of the carapace, is again bordered by a small, low ridge. The outer circumscribing ridge is connected either to the outer dorsal margin or to the low dorsal marginal rim by a short slightly backward trending ridge just posterior to middle.

On the inner side of the inner marginal rim, occasional small, poorly developed short ridges are evident. The surface of the valves is conspicuously punctate. Dimensions of holotype (fig. 16, left valve), length 0.55 mm., height 0.32 mm.; (fig. 17, right valve), length 0.55 mm., height 0.35 mm.

Types.—Holotype, Bandoeng Museum Coll. no. P.S. 1111. Paratype, Colorado School of Mines Coll. no. 1504.

Locality.—E-13. Sangkoelirang Bay, east coast of Borneo, west shore of P. Singkoewang and 1½ kilometers northwest of Sangkoelirang. Miocene.

Remarks.—This species is characterized by its surface punctations and by the sharp elevated inner marginal rim. The form has not been recognized in the Tertiary of either Java or Sumatra.

CYTHERELLOIDEA SUMATRENSIS LeRoy, n. sp.
Plate 83, figures 18–20

Carapace in side view elongate-ovate, valves relatively flat, thickest posteriorly, highest anteriorly. Dorsal margin nearly straight. Ventral margin straight or slightly convex downward, sometimes very faintly depressed near middle. Anterior and posterior ends broadly rounded, anterior somewhat more than posterior. On the left valve a well-defined, broadly rounded inner marginal rim begins just below the anterior dorsal angle and extends uninterruptedly around the anterior, ventral and posterior margins, then merges with the dorsal margin at, or near, the posterior dorsal angle. The right valve sometimes shows a weak, flat rim along the entire dorsal margin. A broad, rounded ridge reaching its highest elevation ventrally encompasses the subcentral circular pit area. At the middle posterior of the area, the circumscribing ridge is connected to the high part of the posterior inner marginal rim by a short ridge. The lower anterior part is connected by a short ridge to the anterior inner marginal rim near the middle. The dorsal part of the circular ridge is either tangent to the faint dorsal rim or merges with the dorsal surface. The ventral part of the circular ridge is connected to the ventral inner marginal rim by six or seven short rather, broad divides. These divides in some specimens are poorly developed. Two rather conspicuous posterior depressions are found on either side of the short ridge connecting the circular ridge and marginal rim. The one just above the posterior ventral angle is the larger of the two. Dimensions of holotype (figs. 18, 19), length 0.50 mm., height 0.30 mm., thickness 0.25 mm.; Paratype (fig. 20, right valve), length 0.50 mm., height 0.30 mm.

Types.—Holotype, Bandoeng Museum Coll. no. P.S. 1110. Paratype, Colorado School of Mines Coll. no. 1508.

Locality.—BR(VB)-104, 8.6 kilometers S. 30° E. of Tr. St. 1460 or 20.5 kilometers S. 50° E. of Rantau Prapat, east coast of

Sumatra, Netherlands Government Topographic Blad 41, 1:100,000, east coast of Sumatra. Miocene.

Remarks.—The surface ornamentation of this species remains quite constant. The circular subcentral pit area bordered by a broad, rounded ridge should aid in the identification of this species.

Foraminifera associated with this species include: *Orbulina universa* d'Orbigny, *Globorotalia barisanensis* LeRoy, *Cibicides dorsopustulosus* LeRoy, *Rotalia indica* LeRoy, *Robulus sumatrensis* LeRoy, *Bolivina sumatrensis* LeRoy, *Baggina inflata* LeRoy, *Allomorphina trigona* Reuss.

CYTHERELLOIDEA BODJONGENSIS
LeRoy, n. sp.
Plate 83, figure 21

Carapace oblong, ovate, thickest posteriorly and somewhat compressed anteriorly. Dorsal margin faintly depressed near middle. Ventral margin straight and almost parallel to dorsal margin. Anterior end somewhat obliquely rounded. Posterior end broadly and uniformly rounded. A faint poorly developed marginal rim begins near the posterior dorsal angle and continues along the dorsal and anterior margins. At the anterior ventral angle, it becomes more conspicuously developed. From this point, it extends inside the outer ventral margin, then proceeds to a point just above the posterior ventral angle, where it reaches its greatest width and highest elevation, and then turns upward and disappears just below the median line at a moderate distance inside the outer posterior margin. The irregular subcentral pit area is divided into two unequal parts, which are largely circumscribed by a low rounded ridge. This ridge is best defined around the ventral, posterior, and dorsal borders of the area. Anteriorly it merges with the surface of the valve. Small ridges immerge from the ventral inner marginal ridge and connect with the ventral ridge of the subcentral pit. On the outer border of the ridge encompassing the posterior portion of the subcentral pit area, a number of radiating divides immerge and die out in a short distance. Dimensions of syntype (right valve), length 0.45 mm., height 0.30 mm.

Syntype.—Bandoeng Museum Coll. no. P.S. 1117.

Locality.—L-3. Road cut 3½ kilometers south of Kampong Bodjong, between kilometer posts 31 and 32 on Pandeglang-Malingping road, Bantam Residency, west Java. Bantamien Pliocene.

Remarks.—The surface pattern of this species is very distinctive. Identification can be based on the general trend and attitude of the inner marginal rim and on the irregularity of the subcentral pit area.

CYTHERELLOIDEA NOMLANDI LeRoy, n. sp.
Plate 83, figures 22, 23

Carapace elongate in side view, length about twice the height. Dorsal margin straight. Ventral margin, conspicuously depressed just anterior to middle. Anterior and posterior extremities broadly rounded, anterior slightly more than posterior. A narrow, elevated, inner marginal rim begins just below the anterior dorsal angle and continues around the anterior and ventral margins and the lower two-thirds of the posterior margin. It branches just below the posterior dorsal angle. The shorter branch extends to the dorsal margin. The other branch extends forward, angles downward, and merges with the ventral part of the ridge circumscribing the circular subcentral pit area. Dimensions of syntype (right valve), length 0.45 mm., height 0.20 mm.

Syntype.—Bandoeng Museum Coll. no. P.S. 1122. Topotype, Colorado School of Mines Coll. no. 1505.

Locality.—N-5500. 11 kilometers S. 20° W. from Kampoeng Doemai, Sultanate of Siak, east coast of Sumatra, Netherlands Government Topographic Blad 20/XIV. Miocene.

Remarks.—The surface ornamentation of this species is very distinctive. Some specimens show a faint reflection of a ridge extending anteriorly from the ventral side of the subcentral pit area, but never reaches the inner marginal rim. The species shows no relationship to any other species described from the East Indian region. This species is named in honor of Dr. J. O. Nomland of the Standard Oil Company of California.

CYTHERELLOIDEA ORIENTALIS
LeRoy, n. sp.
Plate 83, figures 24, 25

Carapace elongate-ovate in side view, thickest posteriorly, height about two-thirds length, slightly higher anteriorly. Dorsal margin straight or faintly arched. Ventral margin nearly straight, slightly depressed near middle. Anterior and posterior extremities broadly rounded. A high, well-rounded inner marginal rim begins at the posterior dorsal angle and continues completely around the valve, gradually widening along the ventral side to a point just above the anterior ventral angle, where it continues to widen and form a broad surface that slopes toward but fails to reach the outer anterior margin. It becomes less broad again at the anterior dorsal angle and finally forms a low, narrow rim that extends along the dorsal margin until the circuit is completed at the posterior dorsal angle. At the posterior end, in some specimens, the inner marginal rim is rather straight and lies approximately normal to the median line giving a somewhat truncate character to the valve. At the outer boundary of the rim on the posterior, ventral and anterior portions numerous small elongate porelike indentations are present. The elongate subcentral pit area is encompassed by a broad, rounded ridge. The area is divided into three parts by two small transverse divides. The encompassing ridge is connected to the dorsal marginal rim near center by two short ridges and to the upper part of the posterior inner marginal rim by a single ridge. The ventral and anterior area between the circumscribing subcentral pit ridge and the inner marginal rim contains numerous short connecting divides. Dimensions of holotype (fig. 24, right valve), length 0.52 mm., height 0.32 mm.; paratype (fig. 25, right valve), length 0.55 mm., height 0.33 mm.

Types.—Holotype, Bandoeng Museum Coll. no. P.S. 1109. Paratype, Colorado School of Mines Coll. no. 1506.

Locality.—E-13. Sangkoelirang Bay, east coast of Borneo, west shore of P. Singkoewang, 1½ kilometers northwest of Sangkoelirang. Miocene.

Remarks.—This species has been noted only from the late Tertiary of east Borneo. It is related somewhat to *Cytherelloidea sangkoelirangensis* LeRoy, but differs primarily by being less elongate, by showing smaller surface ridges, and by lacking the ridge which extends anteriorly from the subcentral pit area.

CYTHERELLOIDEA BAGANENSIS
LeRoy, n. sp.
Plate 83, figures 28, 29

Carapace oblong in side view, slightly higher and thicker posteriorly. Valves relatively flat. Dorsal margin straight, faintly depressed just anterior to middle in right valve, and straight in left valve. Anterior and posterior ends broadly rounded, posterior slightly more than anterior. Posterior end somewhat thickened. The anterior is slightly compressed. A broad, rounded, slightly arched ridge begins at the posterior middle of the subcentral pit area, extends just above the median line and toward the posterior outer margin, but before reaching it, turns downward and continues around and inside the lower half of the posterior margin; then it continues at a moderate distance from the outer ventral margin, anterior margin and anterior half of the dorsal margin. The ridge finally turns downward to the starting point and continues to loop around the subcentral area, eventually dying out just before reaching the upper part of the anterior inner marginal rim. The subcentral pit area is divided into two unequal parts with the posterior part usually the largest. The ridge bordering the ventral portion of the pit area is connected to the ventral inner marginal rim by four or five small secondary divides. A rather large, conspicuous, elongate depression exists in the lower posterior half of the valve just above the posterior ventral angle. Dimensions of holotype (fig. 28, left valve), length 0.43 mm., height 0.27 mm.; (fig. 29, right valve), length 0.45 mm., height 0.30 mm.

Holotype.—Bandoeng Museum Coll. no. P.S. 1113.

Locality.—WA-376, 25 kilometers north of Teloek Poelau, situated on the east bank of the Rokan River, 4 kilometers upstream from the confluence of the Bangko river, east coast of Sumatra, Netherlands Government Topographic Blad 19/XIII. Miocene.

Remarks.—The ridge circuit of this species is quite distinctive. The large depression in the posterior half and lying just above the posterior ventral angle is an outstanding characteristic of the species. A form closely related to this species occurs sparingly in sediments containing *Katacyclocylpeus annulatus* (Martin) in the Bantam area of west Java.

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A NEW SPECIES OF CIBICIDES FROM THE LOWER PLIOCENE (REPETTO FORMATION) OF SOUTHERN CALIFORNIA

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ABSTRACT—A new foraminifer, *Cibicides repettoensis* from the "lower Pliocene," Repetto formation of the Los Angeles Basin, Southern California, is described and illustrated in this paper. Comments are given pertaining to illustrating, defining, and cataloging new species of Foraminifera.

THE SYSTEMATIC description of a new species of Foraminifera should be accompanied by clearly drawn or photographed specimens. The holotype should be complete in form, specifically defined, thoroughly illustrated, and permanently catalogued. In addition to illustrations of the holotype, one or more paratype specimens should be shown to exhibit the latitude of variation permitted in making specific identification. Comment should be made as to the age of the holotype, its stratigraphical position and associated fauna. A discussion pertaining to its affinity to the nearest related species should be given where possible. An author should not "brief a description." By so doing, he introduces into the literature a source of error. Descriptions and figures of a new species should be presented in such manner that subsequent authors, unable to view the holotype or paratype specimen, will have sufficient basic data from which to make a reasonable identification. A brief summary emphasizing the major morphological features of the species should be presented.

As an example for the above comments, a new species of *Cibicides* from the "lower Pliocene" Repetto formation of Southern California was selected.

Family ANOMALINIDAE
Subfamily CIBICIDINAE
Genus CIBICIDES Montfort, 1808

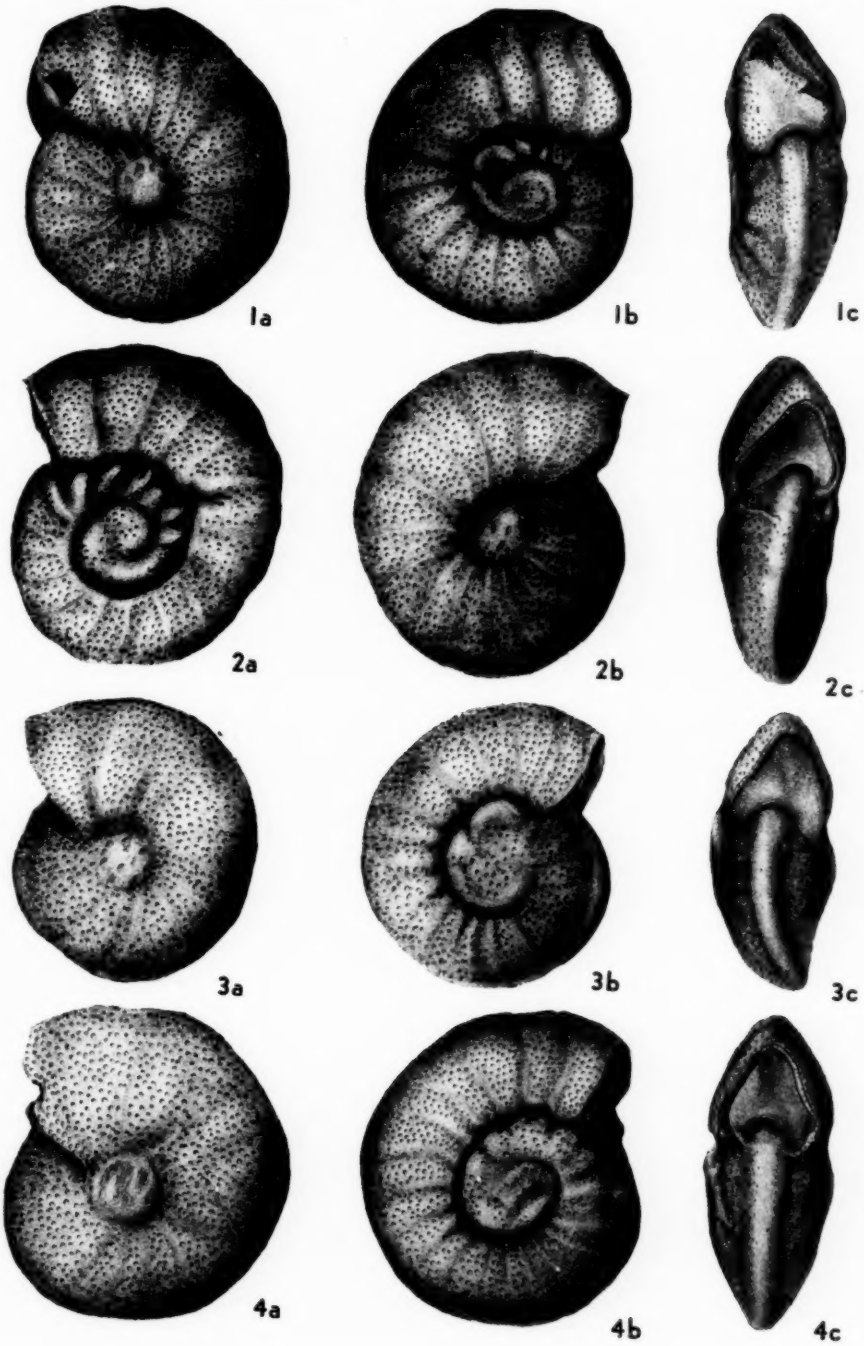
CIBICIDES REPETTOENSIS LeRoy, n. sp.
Plate 84, figures 1–3 (Holotype)
figures 4–12 (Paratypes)

Test large, heavy, robust, nearly bilaterally symmetrical, exhibiting as a general rule slightly more convexity on the ventral side, frequently tending to show some irregularity in coiling, with ventral umbo that varies considerably in its development; a deep, irregular, spiral groove on dorsal side (specimens represented by figures 1a–c and 4a–c clearly exhibit the variation of the dorsal spiral groove); periphery sharply rounded, smooth to very faintly lobulate; chambers moderately distinct, numerous, 18–20 in last-formed whorl, enlarging rather slowly as added, dimensional ratios remaining approximately same during addition; sutures moderately distinct, more so dorsally than ventrally, slightly curved, flush with surface to faintly depressed, depression most conspicuous between last four or five chambers; wall very coarsely perforated; aperture peripheral, a low arch at base of last chamber and with slight covering.

Dimensions.—Holotype (figs. 1a–c) diam-

EXPLANATION OF PLATE 84

FIGS. *1–4*—*Cibicides repettoensis* LeRoy, n. sp. 1a–c, ×136. Holotype. *1*a, Ventral view; *1*b, dorsal view; *1*c, peripheral view. This specimen clearly demonstrates the irregular spiral dorsal groove bordered by secondary calcareous projections. U. S. Nat. Mus. no. 498894. *2*a–c, ×132. Paratype. *2*a, Dorsal view; *2*b, ventral view; *2*c, peripheral view. The characters of this specimen are nearly identical with the holotype, with exception that the ventral side is slightly more evolute. U. S. Nat. Mus. no. 498895. *3*a–c, *4*a–c, ×132. Paratypes. *3*a, *4*a, Ventral views; *3*b, *4*b, dorsal views; *3*c, *4*c, peripheral views. These two specimens exhibit a more regular character of the dorsal spiral groove than does the holotype specimen. U. S. Nat. Mus. no. 498896 (Figs. *3*a–c); and 498897 (Figs. *4*a–c). (p. 622)



Le Roy, Pliocene Foraminifer

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eter 1.10–1.25 mm., thickness 0.55 mm. (U. S. Nat. Mus. no. 498894); Paratype (figs. 2a–c) diameter 1.10–1.30 mm., thickness 0.55 mm. (U. S. Nat. Mus. no. 498895); Paratype (figs. 3a–c) diameter 1.00–1.12 mm., thickness 0.55 mm. (U. S. Nat. Mus. no. 498896); Paratype (figs. 4a–c) diameter 1.15–1.25 mm., thickness 0.57 mm. (U. S. Nat. Mus. no. 498897).

Type locality.—Sample no. 10A. West side of Newport Bay, about 20 feet below top of bluff. Scaled 7.8 inches north—1.70 inches west from the southeast corner of the Newport Beach Quadrangle (U. S. Geol. Survey), Orange County, California.

The specimens were collected by W. H. Holman and L. W. LeRoy on November 15, 1936, and were illustrated by Mr. A. Hamid, Nederlandsche Pacific Petroleum Matschappij, Medan, Sumatra.

Remarks.—Five major morphological features characterize *Cibicides repettoensis:* (1) its rather large size, (2) its coarse punctations, (3) its conspicuously developed dorsal spiral groove, (4) its rather distinct ventral umbo, and (5) its numerous chambers. Occasional specimens, as illustrated in figures 2a–c, tend to show a slight evoluteness on the ventral side. This feature is most clearly shown in specimens lacking the well-developed ventral umbo.

The generic classification of this species is somewhat questionable. Some workers may be inclined to consider the form an *Anomalina* rather than a *Cibicides.*

The species was obtained from the lower part (not more than 200 feet stratigraphically above the Miocene) of the Repetto formation of "lower Pliocene" age. Some characteristic forms associated with *Cibicides repettoensis* are as follows:

Plectofrondicularia californica Cushman and R. E. Stewart
Ellipsonodosaria verneuili (d'Orbigny)
Orbulina universa d'Orbigny
Bulimina rostrata Brady
B. inflata Seguenza
Bolivina sinuata Galloway and Wissler
B. subadvena Cushman var. *sulphurensis* Cushman and Adams
B. argentea Cushman
Nonion pompilioides (Fichtel and Moll)
Uvigerina beccarii Fornasini
Sphaeroidina cf. *variabilis* Reuss
Nodogenerina lepidula (Schwager)

From published literature, the author has been unable to find any species closely related to this newly recorded form.

MANUSCRIPT RECEIVED BY THE EDITOR OCTOBER 25, 1940.

JOURNAL OF PALEONTOLOGY, VOL. 15, NO. 6, PP. 624–628, PL. 85, NOVEMBER, 1941

NEW FORAMINIFERA FROM THE DENTON FORMATION IN NORTHERN TEXAS

DON G. VIEAUX
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ABSTRACT—Ten new species of Lower Cretaceous (Washita) representing the genera *Reophax*, *Palmula*, *Marginulina*, *Nodosaria* (two species), *Frondicularia*, *Dentalinopsis* (two species) *Epistomina*, and *Discorbis* are described and illustrated.

THE descriptions of new species of Foraminifera herein presented form part of a thesis offered the University of Oklahoma as partial fulfillment of a master's degree in geology.

The writer wishes here to express his appreciation to Professor R. W. Harris, who directed the work and aided with valuable suggesions in the writing of the paper, and Dr. C. G. Lalicker for use of holotypes for comparison of textularian forms herein described.

LOCATION AND DESCRIPTION OF OUTCROPS

The entire collection was made in the vicinity of Denison, Grayson County, Texas. In this area there are several well-exposed outcrops of the Denton formation (Washita group, lower Cretaceous).

Locality A.—Denton formation at Flagpole Hill, 3½ miles northeast of Denison, on Riverside Park Road, Grayson County, Texas.

Section

Sample No.	
5	4 feet of section just above no. 4.
4	4 feet of section just above no. 3.
3	1½ feet of section just above no. 2.
2	basal 1½ feet of section.

Locality B.—Section of the Denton-Weno contact in the cut of the St. Louis and San Francisco railroad, just west of the Riverside Park road, about 1½ miles northeast of Denison, Grayson County, Texas, at the 633.1 milepost of the railroad.

Section

Sample No.		Ft.	In.
	Shell-breccia of *Gryphea washitensis*.....	0	2
4	Very fossiliferous, light tan or brown shale-break in the breccia.....	0	6
	Shell-breccia of *Gryphea washitensis*.....	0	5
3	Blue marl with sandy streaks, just above the sandstone and just below the shell-breccia.....	3	0
	Hard, gray sandstone, laminae average ¼ inches in thickness, weathered surface is red and brown.	0	5
	Yellow-brown, friable, sandstone.....	0	2
	Grayish-green, fossiliferous sandstone.....	0	2
2	Dark blue bituminous shale, base of cut.....	2	0

Locality F.—Denton formation, in creek bank in Munson Park, west of U. S. highway 75 and just north of exit from park, one mile north of Denison, Texas.

Section

Sample No.		Ft.	In.
7	Very fossiliferous, yellowish marl, many *Grypheas*, (top 6 to 8 inches are weathered).....	1	8
	Alternating beds of *Gryphea* breccia (1 inch thick) and thin stringers of marl.....	0	5.5
8	Blue-gray marl, with yellow sandy laminae...	1	7
	Gryphea breccia, alternating with sandy shale.	1	5
9	Very fossiliferous blue marl, containing *Gryphea washitensis*, *Pecton* sp., *Ostrea carniata*.....	2	2
	Sandstone, yellow-brown when weathered, blue-gray on fresh surface; beds about ¾ inch thick..	0	9.5
10	Clay, upper 30 inches yellow-brown clay or shale, with two or three ½-inch sand beds at the top; lower 15 inches bluish clay, botton of section exposed in creek...	3	9

SYSTEMATIC DESCRIPTIONS

Family REOPHACIDAE

Genus REOPHAX Montfort, 1808

REOPHAX ECKERNEX

Vieaux, n. sp.

Plate 85, figure 1

Test free, adult specimens resembling a flattened acorn in its cup; the young specimens are single-chambered and flat, adults have graduated chambers, the smallest being at the base and each succeeding chamber gradually expanding as added, last formed chamber terminated in neck in the end of which the simple and circular aperture is located; scalloped periphery, sutures when present are well defined, test covered by fairly well-sorted particles of sand, usually brown in color. Length. 0.90 mm.; width 0.45 mm.

Holotype.—No. WD-3, Oklahoma Univ.

Known range.—Throughout Washita group.

Type locality.—Locality F, sample 7.

Remarks.—This species is quite easily recognized by its unusual shape and brown color.

Family LAGENIDAE

PALMULA LIMBATA Loeblich and Tappan

Plate 85, figures 2a–b

Palmula limbata LOEBLICH and TAPPAN, *1941*, Bull. Am. Paleontology, vol. 26, no. 99, p. 12, pl. 1, figs. 6–10.

Test free, elliptical in outline, widest centrally, basal portion thick with weakly developed peripheral keel; basal chambers well defined by limbate sutures swinging up to form the chevron-shaped later chambers; periphery of compressed later chambers truncate, the last-formed chambers do not contact the early coiled portion; walls smooth, calcareous; aperture radiate and terminal. Greatest width 1.36 mm.; length 1.97 mm.

Holotype.—No. WD-22, Oklahoma Univ.

Known range.—Denton formation through Grayson formation.

Locality.—Locality F, sample 8.

Remarks.—This species is probably the most spectacular of all the forms in the Denton formation. Because of its great size and robust condition, it is very readily recognized. One other form, *P. pilulata* Cushman (1938, p. 37, pl. 6, fig. 2) is noted in the literature. *P. pilulata* was described from the Bonham marl. Though there is a distinct resemblance, that species can be differentiated from *P. limbata* by the greatly limbate condition of the early sutures in the latter. Furthermore the later chambers of *P. pilulata* all come back to the coiled portion, in contrast to *P. limbata*. In *P. limbata* the limbate sutures of the coiled portion converge in the umbilical area to form a heavy plug.

Genus MARGINULINA

d'Orbigny, 1826

MARGINULINA CYPRINA

Vieaux, n. sp.

Plate 85, figures 3a–b

Test free; the general shape is that of a coiled lenticular base with the last two or three chambers being uniserial; chambers radiate, reflecting the coiled condition of the base; periphery sharp; sutures raised and limbate in the coiled portion, depressed in the uniserial portion; wall smooth; aperture radiate and at top of the face of the last chamber. Height 0.63 mm.; width 0.45 mm.

Holotype.—No. WD-23, Oklahoma Univ.

Known range.—Denton formation.

Type locality.—Locality F, sample 8.

Remarks.—This species may be recognized easily by the convergence of the sutures of the coiled portion at the umbilicus to form a rough beaded circle.

NODOSARIA HARRISI

Vieaux, n. sp.

Plate 85, figure 4

Test large and free; periphery lobate, chamber very definite and round; sutures highly constricted; wall has ten costae distributed equidistant around the chambers, vertically continuous from base of specimen to collar at top; aperture terminal and circular in end of tube arising out of slightly produced collar. Length 0.79 mm.; width 0.25 mm.

Holotype.—No. WD-30, Oklahoma Univ.

Known range.—Washita group.

Type locality.—Locality F, sample 8.

Remarks.—This form is by far the largest representative of the genus in the Denton formation. This form differs from *N. affinis*

d'Orbigny (d'Orbigny, 1846, p. 39, pl. 1, figs. 36–39) in the greater number of costae and consistent inflation of later chambers.

NODOSARIA BARKERI
Vieaux, n. sp.
Plate 85, figure 5

Test free; elongate series of chambers gradually increasing in size from the earliest to the latest, this increase may be irregular; chambers unequal, clear, nine costae spaced at equal intervals around the chamber; sutures deeply depressed; aperture located at end of tube which is centered inside of slightly produced collar. Length 0.81 mm.; width 0.15 mm.

Holotype.—No. WD-31, Oklahoma Univ.

Known range.—Denton formation.

Type locality.—Locality A, sample 2.

Remarks.—The first three chambers of tests of this species are small and about equal in size, but the fourth is three or four times as large.

Genus FRONDICULARIA
Defrance, 1826

FRONDICULARIA LALICKERI
Vieaux, n. sp.
Plate 85, figure 6

Test free; small, elliptical, late chambers have their origin about one-third of the way from the bottom, chambers are very narrow, especially at base; sutures slightly depressed; walls smooth; aperture round and terminal. Length 0.90 mm.; width 0.40 mm.

Holotype.—No. WD-39, Oklahoma Univ.

Known range.—Denton formation.

Type locality.—Locality B, Sample 4.

Remarks.—This form may be identified readily by its flat body and narrow chambers. It is the only representative of the genus as yet found in the Denton.

Family BULIMINIDAE
Subfamily BULIMININAE
Genus DENTALINOPSIS
Reuss, 1860

DENTALINOPSIS GIGANTEA
Vieaux, n. sp.
Plate 85, figures 7a–b

Test concavo-triangular in cross section; successive chambers cap the preceding; proloculum spherical; uniserial throughout; sutures distinct and slightly depressed between the outer margins of the test, the depression barely visible at the margins; periphery smooth; walls smooth and translucent, aperture terminal and tripartite. Length 1.35 mm.; width 0.45 mm.

Holotype.—No. WD-46, Oklahoma Univ.

Known range.—Denton formation.

Type locality.—Locality B, sample 2.

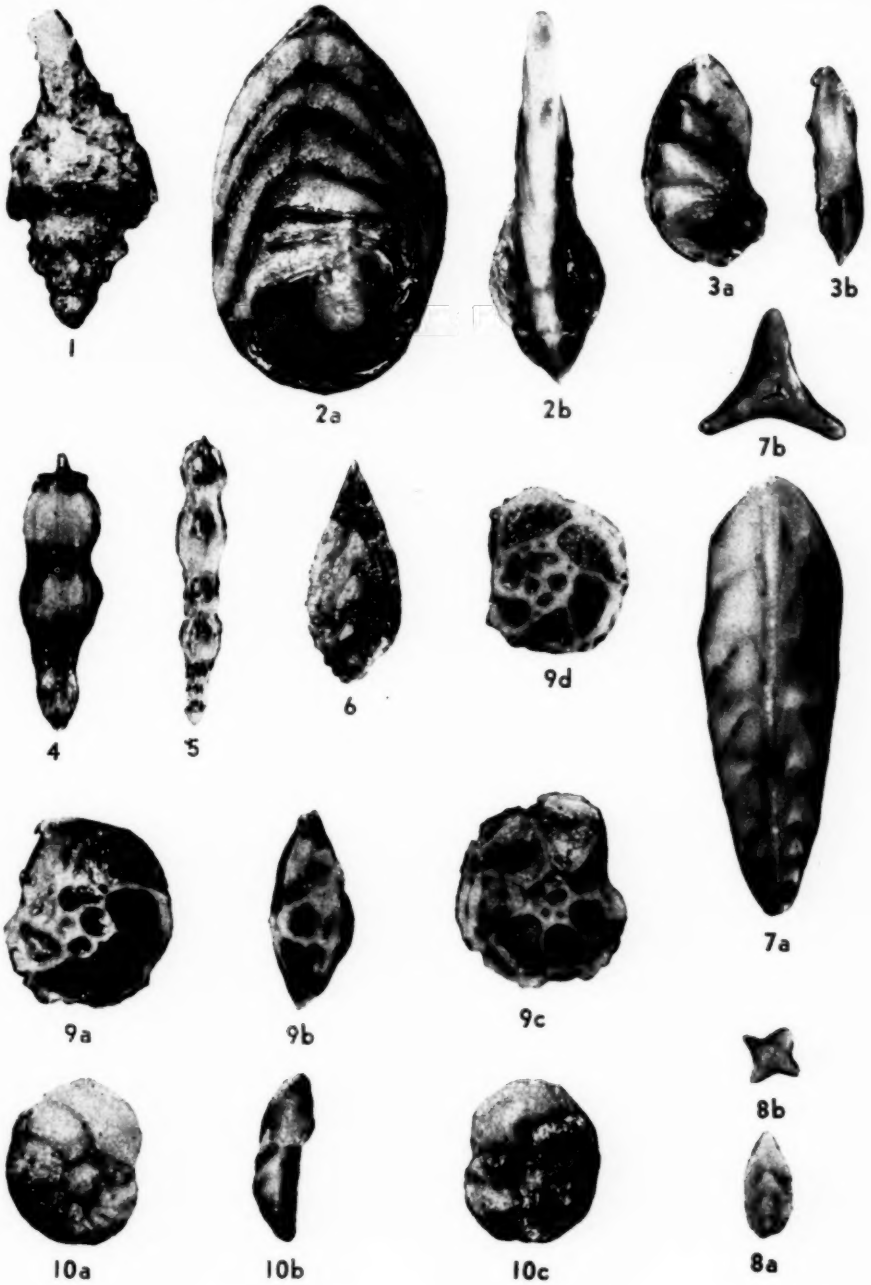
Remarks.—*Dentalinopsis tricarinatum* Reuss var. *acutangulum* Reuss (1862, p. 55, pl. 4, figs. 14a–b) found in the Gault of England and France, and the Hils formation of north Germany compares very closely with *D. gigantea*. *D. tricarinatum* has deeply depressed sutures and lobulate periphery, while *D. gigantea* has only slightly depressed sutures, and no flare to the chambers to give a lobulate periphery. The specimen figured by Reuss shows a triangular aperture, which could have been tripartite in the earlier stages. A perfect aperture is very rare in adult specimens. *D. excavata* (Reuss, 1862, p. 91, pl. 12, figs. 18a–c) has the same general appearance, but it possesses a round aperture, also the outer margins are more closely parallel.

DENTALINOPSIS QUADRATA
Vieaux, n. sp.
Plate 85, figures 8a–b

Test free, concave-rectangular in section;

EXPLANATION OF PLATE 85

FIGS. *1*—*Reophax eckernex* Vieaux, n. sp. ×50. (p. 625)
2a–b—*Palmula limbata* Loeblich and Tappan *a*, side view; *b*, edge view ×25. (p. 625)
3a–b—*Marginulina cyprina* Vieaux, n. sp. *a*, side view; *b*, edge view, ×50 (p. 625)
4—*Nodosaria harrisi* Vieaux, n. sp. ×50. (p. 625)
5—*Nodosaria barkeri* Vieaux, n. sp. ×50. (p. 626)
6—*Frondicularia lalickeri* Vieaux, n. sp. ×50. (p. 626)
7a–b—*Dentalinopsis gigantea* Vieaux, n. sp. *b*, apertural view, ×50. (p. 626)
8a–b—*Dentalinopsis quadrata* Vieaux, n. sp. *b*, apertural view, ×50 (p. 626)
9a–d—*Epistomina charlottae* Vieaux, n. sp. *a*, dorsal view; *b*, edge view; *c*, ventral view; *d*, specimen used to show more perfect dorsal view than holotype, ×50. (p. 627)
10a–c—*Discorbis minima* Vieaux, n. sp. *a*, dorsal view; *b*, edge view; *c*, ventral view, ×50. (p. 627)



Vieaux, Cretaceous Foraminfera

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peripheries sharp, each chamber capping the preceding and approximately the same size following the first few chambers; sutures depressed slightly; walls smooth; aperture terminally located on a small rounded constriction. Length 0.31 mm.; width 0.16 mm.

Holotype.—No. WD-47, Oklahoma Univ.

Known range.—Denton, rare.

Type locality.—Locality A, sample 2.

Remarks.—*Dentalinopsis maertensi* (Reuss) has some of the same characteristics as *D. quadrata*. It has been found in middle Hils clay in Germany and one specimen in the Gault at Folkestone, England. This form is very rare. The two forms possess the quadrangular condition in cross section. However, *D. martensi* as recorded is a much larger and more robust form. It has as many as 10 chambers, while *D. quadrata* seldom has been found with more than four.

Family ROTALIIDAE

Subfamily SIPHONININAE

Genus EPISTOMINA
Terquem, 1883

EPISTOMINA CHARLOTTAE
Vieaux, n. sp.
Plate 85, figures 9a–d

This form is characterized by its biconvex, free test, which is subcircular in outline; the sutures heavily produced, forming an irregular relief around the chambers and attaining maximum development in the umbilical area; the aperture consists of a slit at the base of the last formed chamber and a series of accessory aperture slits located ventrally on the periphery. Width 0.47 mm.; thickness 0.22 mm.

Holotype.—No. WD-50, Oklahoma Univ.

Known range.—Ft. Worth to Weno.

Remarks.—This species is very unique in produced condition of the sutures. In all cases noted the specimens were composed of white, smooth calcareous appearing material. The author, after having examined specimens of *E. spinulifera* (Reuss) (Chapman, 1898, p. 9, pl. 11, figs. 1a–c) from the Gault of Folkestone, England, concludes that the specimen herein figured is a new and distinct species. *E. spinulifera* is the only form found illustrated in the literature which could be confused with *E. charlottae*, n. sp. The Denton specimens average five to six chambers in the last whorl and possess no spines, while *E. spinulifera* averages eight chambers in the last whorl and has well-developed spines along the periphery.

Genus DISCORBIS
Lamarck, 1804

DISCORBIS MINIMA
Vieaux, n. sp.
Plate 85, figures 10a–c

Test free, outline subcircular in young to slightly elongate in adult; dorsal face gently convex, ventral side concave; 13 to 14 chambers visible dorsally with eight to 10 chambers in last-formed coil; definite umbilical depression, slightly covered on one side by umbilical flaps of the last-formed chambers; early coils of dorsal umbilical area occasionally thickened into a plug; sutures slightly depressed; wall calcareous, covered with find punctae; aperture a curved slit on the ventral side at the base of last-formed chamber. Average diameter, 0.40 mm.

Holotype.—No. WD-51, Oklahoma Univ.

Known range.—Fort Worth to Denton.

Type locality.—Locality B, sample 2.

Remarks.—This form is the only representative of the genus found in the Denton.

OTHER SPECIES
(C. H., S. C.)

The following previously described forms were also recognized:

Haplostiche texana (Conrad) Plummer
Ammobaculites subcretacea Cushman and Alexander
Ammobaculites goodlandensis Cushman and Alexander
Frankeina acutocarinata Cushman and Alexander
Spiroplectammina longa Lalicker
Spiroplectammina goodlandana Lalicker
Spiroplectammina nuda Lalicker
Spiroplectammina alexanderi Lalicker
Textularia rioensis Carsey
Textularia washitensis Carsey
Bigenerina wintoni Cushman and Alexander
Gaudryinella delrioensis Plummer
Placopsilina longa Tappan
Glomospira gordialis (Jones and Parker)
Lenticulina washitensis (Carsey) Plummer
Dentalina communis d'Orbigny
Nodosaria obscura Reuss
Vaginulina recta Reuss

Vaginulina debilis (Berthelin)
Vaginulina kochii Roemer
Vaginulina kochii Roemer var. striolata Reuss
Vaginulina marginulinoides Reuss
Globulina lacrima Reuss
Ramulina globulifera Brady
Gumbelina globulosa (Ehrenberg)
Dentalinopsis excavata (Reuss) Plummer
Spirillina cf. *minima* Schacko
Patellina subcretacea Cushman and Alexander
Gyroidina nitida (Reuss) Plummer
Globigerina washitensis Carsey
Globigerina cretacea d'Orbigny

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JOURNAL OF PALEONTOLOGY, VOL. 15, NO. 6, PP. 629–690, NOVEMBER, 1941

BIBLIOGRAPHY AND INDEX TO NEW GENERA, SPECIES, AND VARIETIES OF FORAMINIFERA FOR THE YEARS 1937 AND 1938

HANS E. THALMANN
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BIBLIOGRAPHY AND INDEX FOR THE YEAR 1937

THE FOLLOWING bibliography comprises 449 titles of publications devoted exclusively or partly to Foraminifera. Publications issued during the year 1937 amount to 405. For the years 1931, 1932, and 1933, respectively, one publication is added; six titles refer to 1934, eight to 1935, and 27 to 1936.

Since the regular issue of annual bibliographies has been started, more than 2500 titles of papers (1931 to 1937) have been printed in this JOURNAL, namely 275 for the year 1931, 344 for 1932, 383 for 1933, 376 for 1934, 393 for 1935, 374 for 1936, and 405 for 1937. This gives an average of one publication per day in which Foraminifera are either described, figured, or mentioned during the past seven years.

From the literature for the year 1937, there are recorded in the following Index 13 new families, six subfamilies, 36 genera, five subgenera, 480 species, 79 varieties and 70 forms, to which the *nomenclatura aperta* has been applied. Four *nomina nuda*, and five additions for the Indices of previous years are also added.

Between 1931 and 1937, there have been put on record 24 new families, 42 subfamilies, 210 genera, 22 subgenera, 2551 species, and 471 varieties of Foraminifera, which amounts to about 30 genera and 365 species per year.

Most of the new forms during 1937 have been described from Eocene beds (about one third of all new forms); Permian, Cretaceous, Oligocene, Pliocene and Recent yielded each about one-tenth of all new species and varieties, Carboniferous and Miocene furnished about eight per cent each, Jurassic four per cent, and only two forms are described as new from the Pleistocene.

The manuscripts for the bibliographies and indexes for the years 1938, 1939, and 1940 are in preparation. The writer would appreciate it very much, if workers in Foraminifera would kindly send information regarding new species and publications especially for the years 1939 and 1940, in order to make the respective bibliographies as complete as possible. Publications of belligerent or occupied countries are either stopped or do not reach the writer. For this reason, and in order to continue the regular annual recording, any help is highly welcome.

I wish to thank most cordially Mrs. Helen Jeanne Plummer and Dr. Norman D. Newell for the editorial reading and preparing for print of this bibliography, and Mrs. Heidi Thalmann for her constant help during the preparation of the manuscript.

Homonyms.—In accordance with Articles 11, 34, 35, and 36 of the International Rules of Zoological Nomenclature, the following forms, erected in 1937, have to be regarded as homonyms, and, consequently, should be renamed by their respective authors within due time. The reference to the previously published valid or original species is given in the following Index:

Bolivina crenulata Loetterle, preoccupied by Cushman, 1936.

Frondicularia frankei Brand, preoccupied by Cushman, 1936.

——— *tenera* (Bornemann, 1854) var. *octocosta* Brand, preoccupied by *Frondicularia octocostata* Burbach, 1886.[1]

Lepidocyclina (*Eulepidina*) *gigas* Cushman, 1919, var. *flexuosa* Silvestri, preoccupied by *Lepidocyclina flexuosa* L. Rutten, 1911.

——— (———) *petri* Thiadens, preoccupied by *Lepidocyclina* (*Nephrolepidina*) *petri* M. G. Rutten, 1935.

Listerella gracillima Cushman and Bermúdez, preoccupied by *Listerella communis* (d'Orbigny, 1826) var. *gracillima* Cushman, 1936.

[1] Rule 35 lists five slight differences in spellings of specific designations that constitute homonyms, and the difference between *-costa* and *-costata* is not covered by this official list. If taxonomists insist on interpreting the Rules, instead of accepting them literally, their fundamental purpose in obviating confusion is defeated.—Helen Jeanne Plummer.

Marginulina texana Cushman, preoccupied by Garrett and Ellis. Cushman's name was published December 10, while the original name appeared in print two days earlier. Cushman has since changed his name to *Marginulina texasensis* Cushman, 1938.

Multilepidina Silvestri, subgen. nov., preoccupied by Hanzawa, 1932, as a subgenus of *Lepidocyclina*.

Nummularia Wedekind, gen. nov., preoccupied by Sowerby, 1826.

Operculina alpina H. Douvillé, 1916, var. *multiseptata* Silvestri, preoccupied by *Operculina bartschi* Cushman, 1921, var. *multiseptata* Yabe and Hanzawa, 1930.

Uvigerina spinulosa Coryell and Embich, preoccupied by *Uvigerina canariensis* d'Orbigny, 1826, var. *spinulosa* Hadley, 1934.

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Alveolina vredenburgi L. M. Davies, **101,** p. 57, pl. 5, fig. 25. Eocene, Punjab. [For: *Alveolina oblonga* Doncieux, 1926, pro parte (non d'Orbigny, 1826), Ann. Univ. Lyon, n.s., vol. 1, p. 76, pl. 8, fig. 2; and for: *Alveolina oblonga* L. M. Davies, 1927, pro parte (non d'Orbigny, 1826), Quart. Jour. Geol. Soc. London, vol. 83, p. 282, text fig. 5.]

Ammobaculites cubensis Cushman and Bermúdez, **86,** p. 106, pl. 16, figs. 4, 16–18. Eocene, Cuba.

——— *discus* Weber, **388,** p. 37, text fig. 2. Lower Miocene, Bruchsal, Germany.

——— *formosensis* Nakamura, **251,** p. 133, pl. 10, fig. 1. Pliocene, Formosa.

——— *globigeriniferus* Bermúdez, **31,**, p. 138, pl. 17, figs. 1, 2. Eocene, Pinar del Rio, Cuba.

——— *penonensis* Cushman and Bermúdez, **86,** p. 107, pl. 16, figs. 13–15. Eocene, Cuba.

——— *parianus* Hedberg, **176,** p. 666, pl. 90, fig. 3. Upper Oligocene, northeastern Venezuela.

——— sp., Parr, **267,** p. 73, pl. 15, fig. 1. Early middle Tertiary, Auckland, New Zealand.

Ammomarginulina tranquillensis Coryell and Embich, **73,** p. 294, pl. 41, fig. 7. Upper Eocene, Panama.

Ammosphaeroidina cubensis Bermúdez, **31,** p. 140, pl. 17, figs. 3, 4. Eocene, Habana, Cuba.

Amphilepidina renzi David-Sylvain, **100,** p. 18, pl. 2, fig. 12. Aquitanian and Burdigalian, Umbria, Italy.

Amphistegina multicamerata Bermúdez, **31,** p. 146, pl. 18, figs. 1–3. Eocene, Pinar del Rio, Cuba.

——— *pinarensis* Cushman and Bermúdez, **86,** p. 109, pl. 16, figs. 10–12. Eocene, Cuba.

Amphitremoidea, gen. nov., Eisenack, **122,** p. 235. Fam. Astrorhizidae? or Rhizamminidae? Genotype: *A citronifera* Eisenack, 1937. Silurian, Baltic Provinces.

——— *citronifera* Eisenack, **122,** p. 235, p. 15, fig. 28; pl. 16, fig. 12. Silurian, Baltic provinces.

Angulogerina angulosa (Williamson, 1858) var. *asperrima* Chapman and Parr, **58,** p. 97, pl. 8, fig. 20. Recent, 328 fathoms, Antarctic.

——— *europaea* Cushman and Edwards, **88,** p. 61, pl. 8, figs. 17, 18. Montian, France.

——— *halkyardi* Cushman and Edwards, **88,** p. 60, pl. 8, fig. 14. Eocene, Biarritz, France.

——— *naranjoensis* Cushman and Bermúdez, **85,** p. 16, pl. 1, figs. 56–58, Eocene, Cuba.

——— *pulchella* Cushman and Edwards, **88,** pl. 61, pl. 8, fig. 19. Eocene, Biarritz, France.

——— *sanjuanensis* Coryell and Embich, **73,** p. 305, pl. 42, fig. 26. Upper Eocene, Panama.

Anomalina *almendarensis* Cushman and Bermúdez, **85,** p. 27, pl. 2, figs. 60, 61, Eocene, Cuba.

——— *colligera* Chapman and Parr, **58,** p. 117, pl. 9, fig. 26. Recent, 1180 fathoms, Antarctic. [For: *Anomalina ammonoides* H. B. Brady, 1884 (non *Rosalina ammonoides* Reuss, 1844), Rep. Challenger, p. 672, pl. 94, figs. 2, 3.]

——— *corrugata* Cushman and Bermúdez, **85,** p. 27, pl. 2, figs. 57–59. Eocene, Cuba.

——— *globulosa* Chapman and Parr, **58,** p. 117, pl. 9, fig. 27. Recent, 675 fathoms, Antarctic. [For: *Anomalina grosserugosa* H. B. Brady, 1884 (non *Truncatulina grosserugosa* Gümbel, 1870), Rep. Challenger, p. 673, pl. 94, figs. 4, 5.]

——— *nolani* Hedberg, **176,** p. 681, pl. 92, fig. 11. Upper Oligocene northeastern Venezuela.

——— *pacoraensis* Coryell and Embich, **73,** p. 301, pl. 43, fig. 13. Upper Eocene, Panama.

——— *pariana* Hedberg, **167,** p. 681, pl. 92, fig. 8. Upper Oligocene, northeastern Venezuela.

——— *pseudoexcolata* Kalinin, **194,** p. 52, pl. 6, figs. 97–99; pl. 7, fig. 100–102. Senonian, Aktiubinsk, Russia. [For: *Rosalina clementina* Beissel, 1891 (non *R. clementiana* d'Orbigny, 1840), Abh. Preuss. geol. Landes-anstatt, Neue Folge, Heft 3, pl. 16, figs. 6–8; and for: *Anomalina clementiana* Dain, 1934 (non d'Orbigny, 1840), Trans. Geol. Oil Prosp. Inst. Leningrad-Moscow, series A, vol. 43, p. 45, pl. 5, fig. 48.]

——— *torcerensis* Albritton, **5,** p. 22, pl. 4, figs. 12–14. Lower Cretaceous, Texas.

Assilina dandotica L. M. Davies, **101,** p. 28, pl. 4, figs. 1–3, 6–8. Eocene, Punjab.

——— *spinosa* L. M. Davies, **101,** p. 31, pl. 4, figs. 11, 12, 16, 17. Eocene, Punjab.

——— *subspinosa* L. M. Davies, **101,** p. 33, pl. 4, figs. 19, 20, 23–26. Eocene, Punjab. [For: *Assilina ranikoti* Nuttall, 1926, pro parte, Geol. Mag., vol. 63, p. 117, pl. 10, figs. 7, 8 (non figs. 9–11).]

Astacolus sp., Coryell and Embich, **73,** p. 296, pl. 42, fig. 4. Upper Eocene, Panama.

Asterocyclina gamboaensis Coryell and Embich, **73,** p. 305, pl. 43, fig. 16. Upper Eocene, Panama.

Astrononion, gen. nov., Cushmans and Edwards, **87,** p. 30. Fam. Nonionidae. Genotype: *Nonionina stelligera* d'Orbigny, 1839, in Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, vol. 2, pt. 2, Foraminifères, p. 128, pl. 3, fig. 12. Eocene?, Oligocene-Recent.

——— *australe* Cushman and Edwards, **87,** p. 33, pl. 3, figs. 13, 14. Oligocene, Victoria, Australia.

——— *fijiense* Cushman and Edwards, **87,** p. 35, pl. 3, figs. 15, 16. Recent, off Fiji Islands. [For: *Nonionina asterizans* H. B. Brady, 1884

[2] The numbers in bold-face type following the author's name in the Index refer to the publications of the preceding Bibliography.

(non Fichtel and Moll, 1798), Rep. Challenger, pl. 109, figs. 1, 2.]

——— *italicum* Cushman and Edwards, **87,** p. 35, pl. 3, figs. 19, 20. Pliocene, Italy.

——— *novo-zealandicum* Cushman and Edwards, **87,** p. 35, pl. 3, fig. 18. Recent, off New Zealand.

——— *sidebottomi* Cushman and Edwards, **87,** p. 31, pl. 3, fig. 8. Recent, Bay of Naples, Italy. For: *Nonionina stelligera* Sidebottom, 1909 (non d'Orbigny, 1839), Mem. Proc. Manchester Lit. Phil. Soc., vol. 53, no. 21, p. 13, pl. 4, fig. 9.

——— *stellatum* Cushman and Edwards, **87,** p. 32, pl. 3, figs. 9–11. Recent, off southern Iceland.

——— *tumidum* Cushman and Edwards, **87,** p. 33, pl. 3, fig. 17. Recent, South Atlantic, 420 fathoms. [For: *Nonionina stelligera* H. B. Brady, 1884, pro parte (non d'Orbigny, 1839), Rep. Challenger, p. 728, pl. 104, fig. 5.]

——— *viragoensis* Cushman and Edwards, **87,** p. 32, pl. 3, fig. 12. Recent, off British Columbia.

Baggina marielina Cushman and Bermúdez, **85,** p. 25, pl. 2, figs. 21–23. Eocene, Cuba.

Bathysiphon carapitanus Hedberg, **176,** p. 665, pl. 90, fig. 1. Upper Oligocene, northeastern Venezuela.

Bermudezina, gen. nov., Cushman, **81,** p. 102. Fam. Verneuilinidae. Genotype: *Heterostomella cubensis* Palmer and Bermúdez, 1936, Mem. Soc. cubana Hist. Nat., vol. 10, p. 244, pl. 13, figs. 1–3; pl. 14, fig. 20. Oligocene and Miocene, Cuba.

Bigenerina hsukuanghsii Lee, **215,** p. 53, pl. 1, fig. 15. Carboniferous, Donetz Basin, Russia.

——— *speciosa* Yabe and Asano, **400,** p. 97, pl. 19, fig. 5. Miocene, west Java.

——— *taiwanica* Nakamura, **251,** p. 136, pl. 10, fig. 9. Pliocene, Formosa.

Biplanispira, gen. nov. (nom. nov.), Umbgrove, **375,** correction sheet, dated January 15, 1937. New name for *Heterospira* Umbgrove, 1936, non Koken, 1896. Genotype: *Biplanispira mirabilis* (Umbgrove, 1936). Tertiary, Borneo.

Bolivina alazanensis Cushman, 1926, var. *venezuelana* Hedberg, **176,** p. 676, pl. 91, figs. 14, 15. Upper Oligocene, northeast Venezuela.

——— *aenariensis* (Costa, 1856) var. *carapitana* Hedberg, **176,** p. 676, pl. 91, fig. 16. Upper Oligocene, northeast Venezuela.

——— *capdevilensis* Cushman and Bermúdez, **85,** p. 14, pl. 1, figs. 49, 50. Eocene, Cuba.

——— *choctawensis* Cushman and McGlamery, in Cushman, **83,** p. 72, pl. 8, fig. 24. Oligocene, Alabama.

——— *crenulata* Loetterle, **223,** p. 38, pl. 6, fig. 1. Upper Cretaceous, Nebraska and South Dakota. (Note: The specific designation is preoccupied by Cushman, 1936, Cushman Lab. Foram. Research, Spec. Publ. 6, p. 50, pl. 7, fig. 13, for an Upper Eocene form in Hungary.)

——— *formosana* Nakamura, **251,** p. 140, pl. 12 fig. 2. Pliocene, Formosa.

——— *longestriata* Fahrion, **128,** p. 199, text figs. 4 5. Upper Cretaceous, Portuguese East Africa.

——— *malkinae* Coryell and Embich, **73,** p. 302, pl. 42, fig. 20. Upper Eocene, Panama.

——— *quadricosta* Cushman and McGlamery, in Cushman, **83,** p. 71, pl. 8, fig. 23. Oligocene, Alabama.

——— *rhumbleri* Franke, 1936, var. *amalthea* Brand, **26,** pl. 185, pl. 7, fig. 1. Liassic, northwest Germany. [For: *Textularia pikettyi* Franke, 1936 (non Terquem, 1866), Abh., Preuss. geol. Landesanstalt, N. F., Bd. 169, p. 125, pl. 12, fig. 19.

——— *sintikuensis* Nakamura, **251,** p. 140, pl. 12, fig. 1. Pliocene, Formosa.

——— *sphenoides* Chapman and Parr, **58,** p. 93, pl. 8, fig. 18. Recent, Antarctic, 1475 fathoms.)

——— *tikutoensis* Nakamura, **251,** p. 140, pl. 12, fig. 3. Pliocene, Formosa.

——— *tranquilla* Coryell and Embich, **73,** p. 303, pl. 42, fig. 21. Upper Eocene, Panama.

——— *tricosta* Cushman and Bermúdez, **85,** p. 14, pl. 1, figs. 51, 52. Eocene, Cuba.

Bolivinella alata Cushman and Bermúdez, **85,** p. 12, pl. 1, fig. 43. Eocene, Cuba.

——— *cubensis* Cushman and Bermúdez, **85,** p. 13, pl. 1, fig. 46. Eocene, Cuba.

Boliviininae, subfam. nov., Glaessner, **152,** p. 420. Fam. Buliminidae. Lower Cretaceous to Recent. It includes the following genera: *Bolivina, Loxostomum, Bifarina, Siphogenerinoides, Siphonodosaria,* and *Chrysalogonium.*

Bolivinita costifera Cushman, **79,** p. 105, pl. 15, fig. 15. Upper Cretaceous, Arkansas.

——— *exigua* Glaessner, **151,** p. 369, pl. 2, fig. 17. Paleocene, northwest Caucasus, Russia.

——— sp. Voorwijk, **384,** p. 195, pl. 1, figs. 21, 22. Upper Cretaceous, Cuba.

Bolivinoides austinana Cushman, **79,** p. 104, pl. 15, fig. 10. Upper Cretaceous, Texas.

——— *planulis* Coryell and Embich, **73,** p. 303, pl. 42, figs. 12, 13. Upper Eocene, Panama.

——— *texana* Cushman, **79,** p. 104, pl. 15, fig. 12. Upper Cretaceous, Texas.

Bolivinopsis suturalis Kalinin, **194,** p. 15, pl. 1, fig. 5. Upper Cretaceous, Aktiubinsk, Russia.

Borelis cardenasensis Barker and Grimsdale, **22,** p. 174, pl. 9, figs. 1–5. Upper Cretaceous, Mexico.

Bulimina alsatica Cushman and F. L. Parker, **93,** p. 39, pl. 4, figs. 6, 7. Oligocene, Alsace, France.

——— *bleeckeri* Hedberg, **176,** p. 675, pl. 91, figs. 12, 13. Upper Oligocene, northeast Venezuela.

——— *brevitrigona* Chapman and Parr, **58,** p. 85, pl. 8, fig. 13. Recent, Antarctic, 125 fathoms.

——— *buchiana* d'Orbigny, 1846, var. *gutta* Chapman and Parr, **58,** p. 86, pl. 8, fig. 14. Recent, Antarctic, 1320 fathoms.

——— *consanguinea* F. L. Parker and Bermúdez, **265,** p. 515, pl. 59, fig. 2. Eocene, Cuba.

——— *elongata* d'Orbigny, 1826, var. *lappa* Cushman and F. L. Parker, **94,** p. 51, pl. 7, fig. 8. Miocene, Australia.

——— ——— ——— var. *subulata* Cushman

and F. L. Parker, **94,** p. 51, pl. 7, figs. 6, 7. Miocene, Australia.
——— *impendens* F. L. Parker and Bermúdez, **265,** p. 514, pl. 58, figs. 7, 8. Eocene, Cuba.
——— *jugosa* Cushman and F. L. Parker, **93,** p. 38, pl. 4, fig. 5. Oligocene, Ecuador.
——— *palmerae* F. L. Parker and Bermúdez, **265,** p. 514, pl. 59, fig. 1. Eocene, Cuba.
——— *rugifera* Glaessner, **151,** p. 372, pl. 2, fig. 19. Paleocene, northwest Caucasus, Russia. [For: *Bulimina velascoensis* White, 1929 (non *Gaudryina velascoensis* Cushman, 1925), Jour. Paleontology, vol. 3, p. 50, pl. 5, fig. 13.]
——— *sculptilis* Cushman, 1923, var. *laciniata* Cushman and F. L. Parker, **93,** p. 38, pl. 4, fig. 4. Oligocene, Oregon. [For: *Bulimina sculptilis* Cushman and Schenck, 1938 (non Cushman, 1923), Univ. California Publ., Bull. Dept. Geol. Sci., vol. 17, p. 311, pl. 43, fig. 16.]
——— *semicostata* Nuttall, 1930, var. *crassicosta* F. L. Parker and Bermúdez, **265,** p. 513, pl. 58, fig. 4. Eocene, Cuba.
——— *tarda* F. L. Parker and Bermúdez, **265,** p. 514, pl. 58, fig. 6. Eocene, Cuba.
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——— *bassendorfensis* Cushman and F. L. Parker, **93,** p. 40, pl. 4, fig. 13. Oligocene, Oregon.
——— *grata* F. L. Parker and Bermúdez, **265,** p. 515, pl. 59, fig. 6. Eocene, Cuba.
——— ——— ——— ——— var. *spinosa* F. L. Parker and Bermúdez, **265,** p. 516, pl. 59, fig. 7. Eocene, Cuba.
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——— sp. B, Thiadens, **361,** p. 95, pl. 15, fig. 3; text figs. 3-B, D. Oligocene, Cuba.
——— sp. C, Thiadens, **361,** p. 95, pl. 15, fig. 4; pl. 16, figs. 7, 10. Upper Cretaceous, Cuba.
——— sp. D, Thiadens, **361,** p. 97, text figs. 2-G. Upper Eocene, Cuba.
——— *vermunti* Thiadens, **361,** p. 94, pl. 16, figs. 1, 11, 12; text figs. 2-C, 3-A, 3-E. Upper Cretaceous, Cuba.
Cancris cubensis Cushman and Bermúdez, **85,** p. 25, pl. 2, figs. 48–50. Eocene, Cuba.
Cassidulina carapitana Hedberg, **176,** p. 680, pl. 92, fig. 6. Upper Oligocene, northeast Venezuela.
——— *japonica* Asano and Nakamura, **14,** p. 144, pl. 13, figs. 1, 2; text figs. 2. Pliocene and Recent, Japan.
——— *kazusaensis* Asano and Nakamura, **14,** p. 146, pl. 14, fig. 2; text fig. 7. Pliocene, Japan.
——— *sagamiensis* Asano and Nakamura, **14,** p. 147, pl. 14, fig. 5. Pliocene, Japan.
——— *setanaensis* Asano and Nakamura, **14,** p. 146, pl. 13, fig. 7. Pliocene, Hokkaido, Japan.
——— *subglobosa* H. B. Brady, 1881, var. *depressa* Asano and Nakamura, **14,** p. 148, pl. 13, fig. 8. Pliocene, Japan.
——— ——— ——— var. *parva* Asano and Nakamura, **14,** p. 148, pl. 13, fig. 5. Pliocene, Japan.
——— ——— ——— var. *producta* Chapman and Parr, **58,** p. 82, pl. 8, fig. 12. Recent, Antarctic, 1180 fathoms.
——— *sublimbata* Asano and Nakamura, **14,** p. 146, pl. 14, figs. 3, 4. Pliocene, Japan.
——— *wakasaensis* Asano and Nakamura, **14,** p. 149, pl. 14, fig. 7. Recent, Wasaka Bay, 190 metres, Japan.
——— *yabei* Asano and Nakamura, **14,** p. 145, pl. 14, fig. 1. Pliocene, Hokkaido, Japan.
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Chitinodendron, gen. nov., Eisenack, **122,** p. 236. Systematic position within the Foraminifera still uncertain. Genotype: *Chitinodendron bacciferum* Eisenack, 1937. Silurian, Baltic provinces.
——— *bacciferum* Eisenack, **122,** p. 236, text figs. 9–17; pl. 16, fig. 6. Silurian, Baltic provinces.
——— *longicarpus* Eisenack, **122,** p. 236, text figs. 18–20. Silurian, Baltic provinces.
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——— *dickersoni* Bermúdez, **34,** p. 244, pl. 21, figs. 8, 9. Upper Eocene, Cuba.
——— *havanensis* Cushman and Bermúdez, **85,** p. 28, pl. 3, figs. 1–3. Eocene, Cuba.
——— *sintikuensis* Nakamura, **251,** p. 142, pl. 12, fig. 9. Pliocene, Formosa.
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——— *eucarinatus* Cushman and Bermúdez, **85,** p. 3, pl. 1, figs. 10, 11. Eocene, Cuba.
——— *excurrens* Cushman and Bermúdez, **85,** p. 3, pl. 1, figs. 14, 15. Eocene, Cuba.
——— *havanensis* Cushman and Bermúdez, **85,** p. 3, pl. 1, figs. 12, 13. Eocene, Cuba.
——— *marielinus* Cushman and Bermúdez, **85,** p. 4, pl. 1, figs. 16, 17. Eocene, Cuba.
——— *subulatus* Cushman and Bermúdez, **85,** p. 2, pl. 1, figs. 8, 9. Eocene, Cuba.
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Codonofusiella, gen. nov., Dunbar and Skinner, **116,** p. 606. Fam. Fusulinidae; subfam. Fusulininae. Genotype: *Codonofusiella paradoxica* Dunbar and Skinner, 1937. Upper Permian, Texas and British Columbia.

——— *paradoxica* Dunbar and Skinner, **116,** p. 607, pl. 45, figs. 1–9. Permian, Texas.

Cornuspira involvens (Reuss, 1850) var. *corticata* Chapman and Parr, **58,** p. 128, pl. 9, fig. 32. Recent. Antarctic, 125 fathoms.

Cribropullenia, gen. nov., Thalmann, Palaeont. Zeitsch., vol. 10, review no. 1349, p. 351. Genotype: *Nonion? marielensis* Palmer, 1936, Mem. Soc. cubana hist. nat., vol. 10, p. 127, text figs. 1–3. Lower Oligocene, Cuba.

Cristellaria münsteri (Roemer, 1839) forma *a* Bartenstein, **26,** p. 174, pl. 9, fig. 50. Lower Dogger, northwest Germany. For: *Cristellaria sowerbyi* Schwager, 1867, Benecke's Geognost.-Pal. Beitr., vol. 1, 1868, p. 660, pl. 34, fig. 18.

——— (*Astacolus*) *rectalonga* Brand, **26,** p. 172, pl. 4, fig. 80. Liassic, Northwest Germany. [For: *Cristellaria antiqua* Terquem, 1858 (non d'Orbigny, 1849), Mem. Acad. imper. Metz, vol. 39, p. 620, pl. 3, fig. 15; pl. 4, fig. 5.]

——— sp., Bartenstein, **25,** p. 337, text fig. 6. Middle Devonian, Eifel, Germany.

——— (*Lenticulina*) *subalata* Reuss, 1854, forma *a*, Bartenstein and Brand, **26,** p. 177, pl. 9, fig. 55; pl. 10, fig. 42. Lower and middle Dogger, northwest Germany. [For: *Cristellaria helios* Terquem, 1870, Mém. Acad. imper. Metz, vol. 50, p. 445, pl. 16, figs. 19–21.]

——— ——— *varians* Bornemann, 1854, forma *a*, Bartenstein and Brand, **26,** p. 176, pl. 10, fig. 40; pl. 11a, fig. 14; pl. 40b, fig. 21. Dogger, northwest Germany. [For: *Cristellaria* (*Lenticulina*) *varians* Bornemann, 1854, var. *recta* Franke, 1936, Abh. Preuss. geol. Landesanstalt, N.F., vol. 169, p. 113, pl. 9, fig. 12.]

——— ——— ——— ——— forma b, Bartenstein and Brand, **26,** p. 176, pl. 2b, fig. 32; pl. 3, fig. 32. Lower Liassic, northwest Germany. [For: *Cristellaria* (*Lenticulina*) *varians* Bornemann, 1854, var. *suturalis-costata* Franke, 1936, Abh. Preuss. geol. Landesanstalt, N.F., vol. 169, p. 113, pl. 11, fig. 13.]

Cristellariidae, fam. nov., Wedekind, **390,** p. 98. Genus: *Cristellaria* Lamarck, 1812. Jurassic to Lower Cretaceous.

Cyclogypsinoides, subgen. nov., Silvestri, **333,** p. 201. No subgenotype given. Proposed for cycloclypeid *Miogypsinae* with cyclical arranged equatorial chambers, but without extra-equatorial chambers. No range given.

Cyclorbiculina, gen. nov., Silvestri, **333,** p. 88. Genotype: *Orbiculina compressa* d'Orbigny, 1839, in de la Sagra's Hist. Phys. Nat. Cuba, Foraminifères, p. 66, pl. 8, figs. 4–7. Recent.

Cyclopavonina, gen. nov., Silvestri, **333,** p. 93. Genotype: *Cyclopavonina cyclica* Silvestri, 1937. No range given.

——— *cyclica* Silvestri, **333,** p. 93. For cyclical forms of *Pavonina flabelliformis* d'Orbigny, 1826. No range given.

Dentalina bierigi Bermúdez, **34,** p. 243, pl. 21, fig. 3. Upper Eocene, Cuba.

——— *havanensis* Cushman and Bermúdez, **85,** p. 11, pl. 1, figs. 39, 40. Eocene, Cuba.

——— *niobrarensis* Loetterle, **223,** p. 24, pl. 2, fig. 3. Upper Cretaceous, Nebraska.

Dentalinella, gen. nov., Wedekind, **390,** p. 94. Fam. Marginulinellidae. Liassic. Genotype: *Dentalinella cuneata* Wedekind, 1937.

——— *cuneata* Wedekind, **390,** p. 94, pl. 14, fig. 10. Lower Liassic, Germany.

Dictyoconoides flemingi L. M. Davies, **101,** p. 51, pl. 6, figs. 11–13. Eocene, Punjab, India.

Dictyoconus sp., Vermunt, **378,** p. 39, pl. 1, fig. 6. Upper Eocene, Cuba.

Discocyclina sp. 1, Caudri, **56,** p. 408, pl. 30, fig. 1-c; pl. 31, fig. 4a; pl. 32, fig. 1. Lower Lutetian, Swiss Alps.

——— sp. 2, Caudri, **56,** p. 409, pl. 31, figs. 3, 4b. Lower Lutetian, Swiss Alps.

——— sp. 3, Caudri, **56,** p. 409, pl. 32, fig. 2. Lower Lutetian, Swiss Alps.

——— sp. indet., Vaughan, **377,** p. 162, fig. 112 (5). Middle Eocene, Ecuador.

Discogypsina, gen. nov., Silvestri, **333,** p. 155. Genotype: *Tinoporus vesicularis* Goës, 1882 (non Parker and Jones, 1860, *Orbitolina*), K. Svensk. Vet.-Akad. Handl., vol. 19, no. 4, p. 104, pl. 7, figs. 245–247. Upper Eocene, Italy; Miocene, Australia, and Philippine Islands; Recent, Caribbean Sea and Indian Ocean.

——— sp., Silvestri, **333,** p. 155. [For: *Gypsina vesicularis* (Parker and Jones, 1860) var. *discus* Goës, 1896, in: Chapman, 1901, Jour. Linn. Soc. London, vol. 28, p. 199, pl. 19, fig. 13.] Recent, Funafuti Lagoon.

——— sp., Silvestri, **333,** p. 155. [For: *Tinoporus vesicularis* Goës, 1882 (non *Orbitolina vesicularis* Parker and Jones, 1860), K. Svensk. Vet.-Akad. Handl., vol. 19, p. 104, pl. 7, figs. 245–247.] Recent, Caribbean Sea.

Discorbis dreheri Bartenstein, **26,** p. 192, pl. 6, fig. 45; pl. 8, fig. 42; pl. 10, fig. 47. Lower Dogger, northwest Germany.

——— *incrustatus* Cushman and Bermúdez, **85,** p. 21, pl. 2, figs. 17, 18. Eocene, Cuba.

——— *havanensis* Cushman and Bermúdez, **85,** p. 19, pl. 2, fig. 15. 16. Eocene, Cuba.

——— *margariteus* Chapman and Parr, **58,** p. 104, pl. 8, fig. 22. Recent, Antarctic, 328 fathoms. (Cave: *D. margaritaceus* Earland, 1933.)

Eggerellinae, subfam. nov., Cushman, **82,** p. 30. Fam. Valvulinidae. Lower Cretaceous to Recent. Comprises 18 genera.

Ellipsoglandulina cubensis Cushman and Bermúdez, **85,** p. 17, pl. 1, figs. 66–68. Eocene, Cuba.

——— *principiensis* Cushman and Bermúdez, **85,** p. 18, pl. 2, figs. 1–3. Eocene, Cuba.

Ellipsolagena cucullata Chapman and Parr, **58,** p. 98, pl. 8, fig. 21. Recent, Antarctic, 220 fathoms.

Ellipsonodosaria decurta Bermúdez, **31,** p. 144, pl. 17, figs. 13, 14. Eocene, Cuba.

——— *jabacoensis* Bermúdez, **34,** p. 239, pl. 20, figs. 4, 5. Eocene, Cuba.

——— *modesta* Bermúdez, **34,** p. 238, pl. 20, fig. 3. Upper Eocene, Cuba.

——— ——— ——— var. *prolata* Cushman and

Bermúdez, **86,** p. 109, pl. 16, figs. 1 and 7. Eocene, Cuba.
——— *pseudoscripta* Cushman, **79,** p. 103, pl. 15, fig. 14. Upper Cretaceous, Texas.
Elphidium ezoense Asano, **11,** p. 787, pl. 24, figs. 1, 2. Pliocene, Hokkaido, Japan.
——— *gorbunowi* Stschedrina. (Note: A recent Arctic species from the Kara Sea, published in the Trans. Arctic Inst. Leningrad during 1937; reference not seen by me.)
——— *javanum* Yabe and Asano, **400,** p. 102, pl. 18, fig. 10. Miocene, Java.
——— *subcrispum* Nakamura, **251,** p. 139, pl. 11, fig. 8. Pliocene, Formosa.
——— *taiwanum* Nakamura, **251,** p. 139, pl. 11, fig. 9. Pliocene, Formosa.
——— *tikutoensis* Nakamura, **251,** p. 139, pl. 11, fig. 10. Pliocene, Formosa.
Eoschubertella, subgen. nov., Thompson, **364,** p. 123. Subgenus of *Schubertella* Staff and Wedekind, 1910. Subgenotype: *Schubertella lata* Lee and Chen, 1930, Mem. Nat. Research Inst. Geol. China, vol. 9, p. 111, pl. 6, figs. 9–11. Fam. Fusulinidae, subfam. Schubertellinae. Lower Pennsylvanian.
Eouvigerina sp., Kalinin, **194,** p. 39, pl. 4, figs. 61, 62. Upper Cretaceous, Aktiubinsk, Russia.
Eoverbeekina cheni Thompson and Foster, **365,** p. 135, pl. 23, fig. 12; pl. 24, fig. 11. Middle Permian, Szechuan, China. [For: *Eoverbeekina*? or *Sphaerulina*? Lee, 1933, Mem. Nat. Research Inst. Geol. China, vol. 14, p. 24, pl. 1, fig. 5; and for: *Eoverbeekina intermedia* Chen, 1934, Palaeontologia Sinica, (B), vol. 4, pt. 2, p. 103, pl. 2, fig. 11.]
Epistominidae, fam. nov., Wedekind, **390,** p. 115. Genus: *Epistomina* Terquem, 1883. Middle Jurassic to Lower Cretaceous.
Eponides crebbsi Hedberg, **176,** p. 679, pl. 92, fig. 1. Upper Oligocene, northeast Venezuela.
——— *jucundus* Bermúdez, **31,** p. 145, pl. 18, figs. 4, 5. Eocene, Cuba.
——— *marielensis* Cushman and Bermúdez, **85,** p. 23, pl. 2, figs. 27–29. Eocene, Cuba.
——— *orientalis* Asano, **13,** p. 117, pl. 15, fig. 8. Recent, Siogama Bay, Japan.
——— *principiensis* Cushman and Bermúdez, **85,** p. 23, pl. 2, figs. 30–32. Eocene, Cuba.
——— *rutteni* Cushman and Bermúdez, **85,** p. 24, pl. 2, figs. 33–35. Eocene, Cuba.

Fabularia (?) sp. A, Hanzawa, **169,** p. 113, pl. 20, figs. 5, 6. Eocene, Jamaica.
——— (?) sp. B, Hanzawa, **169,** p. 113, pl. 20, fig. 7. Eocene, Jamaica.
Flabellammina althoffi Bartenstein, **26,** p. 187, pl. 14a, fig. 8; pl. 15a, fig. 41. Dogger, northwest, Germany.
Flabellina henbesti Bermúdez, **31,** p. 142, pl. 17, fig. 11. Eocene, Cuba.
——— *marssoni* Brotzen, **47,** p. 69. New name for: *Flabellina elliptica* (Nilsson, 1825) forma *ovata* (Münster, 1838) in Franke, 1925, Abh. geol. pal. Inst. Univ. Greifswald, vol. 6, p. 63, pl. 5, fig. 11. Upper Cretaceous, Pomerania.
Frondicularia frankei Brand, **26,** p. 155, pl. 4, fig. 47; pl. 7, fig. 4. Liassic, northwest Germany. (Note: This specific designation is preoccupied by Cushman, 1936, Contr. Cushman Lab. Foram. Research, vol. 12, p. 18, pl. 4, fig. 6, 7, for an Upper Cretaceous form from Texas.)
——— *mesoliasica* Brand, **26,** p. 158, text fig. 16; pl. 4, fig. 66. Liassic, northwest Germany.
——— sp., Kalinin, **194,** p. 29, pl. 3, fig. 30. Upper Cretaceous, Aktiubinsk, Russia.
——— *stockheimia* Brand, **45,** p. 377, text fig. 1. Middle part of upper Zechstein, Wetterau, Germany.
——— *tenera* (Bornemann, 1854) var. *prismatica* Brand, **26,** p. 156, text fig. 15; pl. 3, fig. 34. Lower Liassic, northwest Germany.
——— ——— ——— var. *octocosta* Brand, **26,** p. 157, text fig. 15-c, pl. 3, fig. 27. Lower Liassic, northwest Germany. (Note: This varietal name is preoccupied by *Frondicularia octovostata* Burbach, 1886, Zeitschr. Naturwiss. Halle, vol. 59, p. 50, pl. 2, fig. 44.)
Fusulina novamexicana Needham, **253,** p. 23, pl. 2, figs. 11–15. Pennsylvania, New Mexico.
——— *pattoni* Needham, **253,** p. 26, pl. 3, figs. 3–5. Pennsylvania, New Mexico.
——— *socorroensis* Needham, **253,** p. 22, pl. 2, figs. 6–10. Pennsylvanian, New Mexico.
——— *taosensis* Needham, **253,** p. 25, pl. 2, fig. 16; pl. 3, figs. 1, 2. Pennsylvania, New Mexico.

Gallowaiinella, nom. nov., Chen., 1937, in Dunbar and Skinner, **116,** p. 571. Genotype: *Gallowaiina meitiensis* Chen, 1934. Fam. Fusulinidae; subfam. Schwagerininae. Middle upper Permian, China. (Note: This new name is proposed for *Gallowaiina* Chen, 1934, non Ellis, 1932.)
Gaudryina gradata Berthelin, 1880, forma A, Bartenstein and Brand, **26,** p. 184, text fig. 19; pl. 2B, fig. 41. Lower Liassic, northwest Germany.
——— *guanajayensis* Bermúdez, **31,** p. 139, pl. 16, figs. 9–11. Eocene, Cuba.
—— (*Siphogaudryina*) *matusimai* Asano, **12,** p. 1234, text figs. 1–3. Pleistocene, Noto Peninsula, Japan.
——— *nebrascensis* Loetterle, **223,** p. 20, pl. 1, fig. 3. Upper Cretaceous, Nebraska.
——— *torrei* Bermúdez, **31,** p. 138, pl. 16, figs. 4, 5. Eocene, Cuba.
Gladiaria, gen. nov., Wedekind, **390,** p. 105, pl. 16, figs. 3–6. Fam. Robulinidae. Genotype: *Cristellaria decorata* Reuss, 1855, Zeitschr. deutsche geol. Gesell., vol. 7, p. 269, pl. 8, fig. 16; pl. 9, figs. 1, 2.
Glandulina cubensis Cushman and Bermúdez, **85,** p. 12, pl. 1, fig. 42. Eocene, Cuba.
Globigerina bulloides d'Orbigny, 1826, var. *cryptomphala* Glaessner, **153,** p. 29, pl. 1, fig. 1. Upper Eocene, northwest Caucasus, Russia.
——— *dissimilis* Cushman and Bermúdez, **85,** pl. 3, figs. 4–6. Eocene, Cuba.
——— *infracretacea* Glaessner, **153,** p. 28, text fig. 1. Albian, northwest Caucasus, Russia. [For: *Globigerina cretacea* Chapman, 1894, (non d'Orbigny, 1840), Jour. Roy. Microsc. Soc., p. 588, pl. 13, figs. 5, 6; and for: *Glo-*

bigerina bulloides Chapman, 1894 (non d'Orbigny, 1826), Jour. Roy. Microsc. Soc., p. 587, pl. 13, fig. 4.

——— *venezuelana* Hedberg, **176,** p. 681, pl. 92, fig. 7. Upper Oligocene, Venezuela. [For: *Globigerina* sp.?, Cushman and Jarvis, 1930, Jour. Paleontology, vol. 4, p. 366, pl. 34, fig. 5.]

Globorotalia aragonensis Nuttall, 1930, var. *caucasica* Glaessner, **153,** p. 31, pl. 1, fig. 6. Upper middle Eocene, Caucasus, Russia.

——— *centralis* Cushman and Bermúdez, **85,** p. 26, pl. 2, figs. 62–65. Eocene, Cuba.

——— *palmerae* Cushman and Bermúdez, **85,** p. 26, pl. 2, figs. 51–53. Eocene, Cuba.

——— *pseudocrassa* Chapman and Parr, **58,** p. 115, pl. 9, fig. 25. Recent, Antarctic, 2400 fathoms. [For: *Pulvinulina crassa* H. B. Brady, 1884 (non *Rotalina crassa* d'Orbigny, 1840) Report Challenger, p. 694, pl. 103, fig. 12 (non fig. 11).]

——— *pseudoscitula* Glaessner, **153,** p. 32 text fig. 3. Lower Eocene, northwest Caucasus, Russia.

——————————— var. *elongata* Glaessner, **153,** p. 33, text figs. 3d, 3e, and 3f. Upper middle Eocene, Caucasus, Russia.

——— *umbilicata* Loetterle, **223,** p. 43, pl. 6, fig. 9. Upper Cretaceous, Nebraska.

Globotruncana havanensis Voorwijk, **384,** p. 195, pl. 1, figs. 25, 26 and 29. Upper Cretaceous, Cuba.

——— sp., Rao and Rao, **285,** p. 394, pl. 33, figs. 11, 12. Paleocene (?), southern India.

Gonatosphaera pinarensis Bermúdez, **31,** p. 145, pl. 17, figs. 15, 16. Eocene, Cuba.

Gümbelina crinita Glaessner, **151,** p. 383, pl. 4, fig. 34. Paleocene, northwest Caucasus, Russia.

——— *cubensis* Palmer, 1934, var. *heterostoma* Bermúdez, **31,** p. 143, pl. 17, figs. 5–7. Eocene, Cuba.

——— *nuttalli* Voorwijk, **384,** p. 192, pl. 2, figs. 1–9. Upper Cretaceous, Texas.

——— *paucistriata* Albritton, **5,** p. 22, pl. 4, figs. 8–10. Lower Cretaceous, Texas.

——— *plummerae* Loetterle, **223,** p. 33, pl. 5, figs. 1, 2. Upper Cretaceous, Kansas, Nebraska, and South Dakota.

——— sp., Voorwijk, **384,** p. 194, pl. 1, figs. 11 and 13. Upper Cretaceous, Cuba.

Gumbelinidae, fam. nov., Wedekind, **390,** p. 113. Upper Cretaceous to Eocene. Comprises the genera: *Gümbelina, Tubitextularia, Spiroplectoides,* and *Pseudotextularia.*

Guttulina clifdenensis Parr and Collins, **268,** p. 196, pl. 15, fig. 7. Oligocene, New Zealand.

——— *regina* (Brady, Parker, and Jones, 1870) var. *chapplei* Parr and Collins, **268,** p. 194, pl. 12, fig. 7. Lower Miocene, Victoria.

——— sp., Parr and Collins, **268,** p. 193, pl. 13, fig. 1. Upper Cretaceous, Western Australia.

——— *tikutoensis* Nakamura, **251,** p. 138, pl. 11, fig. 5. Pliocene, Formosa.

Gyroidina elongata Cushman and Bermúdez, **85,** p. 22, pl. 2, figs. 36–38 (non figs. 33–35). Eocene, Cuba.

——— *plummerae* Cushman and Bermúdez, **85,** p. 22, pl. 2, figs. 42–44. Eocene, Cuba.

——— *protea* Cushman and Bermúdez, **85,** p. 22, pl. 2, figs. 39–41. Eocene, Cuba.

Haddonia cubensis Cushman and Bermúdez, **86,** p. 107, pl 16, figs. 8, 9. Eocene, Cuba.

Hantkenina liebusi Shokhina, **330,** p. 427, text figs. 1–47; pl. 2, figs. 2, 3. Middle Eocene, northern Caucasus, Russia. [For: *Pullenia kochi* Liebus, 1911, (non *Siderolina kochi* Hantken, 1876), Sitzungsber. Akad. Wiss. Wien, vol. 120, pt. 1, p. 942, pl. 11, figs. 9, 10.

Haplophragmoides sintikuensis Nakamura, **251,** p. 133, pl. 10, fig. 2. Pliocene, Formosa.

——— sp., Bartenstein and Brand, **26,** p. 188, pl. 1-a, fig. 20. Liassic, northwest Germany.

——— sp., Parr, **267,** p. 74, pl. 15, fig. 2. Early middle Tertiary, New Zealand.

——— *taiwanensis* Nakamura, **251,** p. 134, pl. 10, fig. 3. Pliocene, Formosa.

Heronallenia eocenica Bermúdez, **34,** p. 243, pl. 21, figs. 4, 5. Eocene, Cuba.

Heterostegina depressa d'Orbigny, 1826, var. *involuta* Silvestri, **333,** p. 111, pl. 14, fig. 3. Lower Miocene, north Somaliland.

——— *israelskyi* Gravell and M. A. Hanna, **160,** p. 524, pl. 62, figs. 1–4. Upper Oligocene, Texas.

——— *texana* Gravell and M. A. Hanna, **160,** p. 525, pl. 63, figs. 1–4. Upper Oligocene. Texas. [For: *Heterostegina antillea* Cushman, 1919, Carnegie Inst. Washington, Publ. 291, p. 49, pl. 2, fig. 1-b; pl. 5, figs. 1, 2. (Note: Exactly the same reference is given by the authors also for *Heterostegina israelskyi.* This is contrary to the rules of nomenclature. The original Cushman name should be preserved, and the two new names by Gravell and Hanna abolished because they both refer to the same reference type.)]

Heterosteginella, gen. nov., Silvestri, **333,** p. 118. No genotype and no geological range given. The new genus includes the involute *Heterosteginae* without extra-equatorial chambers.

Heterostomella? halconi Hedberg, **176,** p. 667, pl. 90, fig. 9. Upper Oligocene, northeast Venezuela.

——— sp., Coryell and Embich, **73,** p. 294, pl. 41, fig. 10. Upper Eocene, Panama.

Hyperammina sp. Bartenstein, **25,** p. 336, text figs. 2a–f; 3a, b and 8. Middle Devonian, Eifel, Germany.

Ichthyolaria, gen. nov., Wedekind, **390,** p. 93. (pl. 14, fig. 18). Fam. Nodosariellidae. Liassic. Genotype: *Frondicularia bicostata* d'Orbigny, 1849, Prodvome de Paleont., vol. 1, p. 242, No. 256.

Jaculella liassica Brand, **26,** p. 129, pl. 2-b, fig. 1; pl. 3, fig. 4; pl. 4, fig. 3; pl. 5, fig. 5; pl. 7, fig. 5. Liassic, northwest Germany.

Karreriella arenasensis Cushman and Bermúdez, **85,** p. 5, pl. 1, figs. 20, 21. Eocene, Cuba.

——— *cubensis* Cushman and Bermúdez, **85,** p. 4, pl. 1, figs. 18, 19. Eocene, Cuba.

——— *cushmani* Albritton and Phleger, **7,** p. 354, text fig. 1. Upper Cretaceous, Texas.
Kyphopyxa undulata Loetterle, **223,** p. 30, pl. 4, figs. 2, 3. Upper Cretaceous, Nebraska.

Lagena fimbriata H. *B.* Brady, 1881, var. *polita* Chapman and Parr, **58,** p. 66, pl. 7, fig. 8. Recent, Antarctic, 706 fathoms.
——— *multicincta* Chapman and Parr, **58,** p. 68, pl. 7, fig. 9. Recent, Antarctic, 1320 fathoms.
——— *pseudocatenulata* Chapman and Parr, **58,** p. 65, pl. 7, fig. 6. Recent, Antarctic, 125 fathoms. [For: *Lagena catenulata* Reuss, 1863 (non *Entosolenia squamosa* (Montagu, 1803) var. *catenulata* Williamson, 1858) Sitzungsb. k. Akad. Wiss., Wien, vol. 46, pt. 1, p. 332, pl. 6, figs. 75, 76; and for: *idem*, in Heron-Allen and Earland, 1922, British Antarctic (Terra Nova) Exped., 1910, Nat. Hist. Rept., Zool., vol. 6, pt. 2, Protozoa, pt. 2, Foraminifera, p. 152, pl. 5, figs. 16–18.]
——— sp., Albritton, **5,** p. 21, pl. 4, fig. 11. Lower Cretaceous, Texas.
——— sp., Bartenstein, **25,** p. 336, text figs. 1a, b; text figs. 4a, b. Middle Devonian, Eifel, Germany.
Lagenoglandulina subovata (Stache, 1864) var. *chagresensis* Coryell and Embich, **73,** p. 298, pl. 42, fig. 5. Upper Eocene, Panama.
Lamarckina curryi Coryell and Embich, **73,** p. 300, pl. 43, fig. 1. Upper Eocene, Panama.
——— *hispida* Coryell and Embich, **73,** p. 300, pl. 43, fig. 2. Upper Eocene, Panama.
——— nov. sp., Glaessner, **155,** p. 20, pl. 2, figs. 17, 18. Lower Cretaceous, Caucasus, Russia.
——— *torrei* Cushman and Bermúdez, **85,** p. 21, pl. 2, figs. 24–26. Eocene, Cuba.
Leëlla, gen. nov., Dunbar and Skinner, **116,** p. 603. Fam. Fusulinidae; subfam. Fusulininae. Genotype: *Leëlla bellula* Dunbar and Skinner, 1937. Upper Permian, west Texas.
——— *bellula* Dunbar and Skinner, **116,** p. 604, pl. 46, figs. 1–15. Upper Permian, west Texas.
——— *fragilis* Dunbar and Skinner, **116,** p. 605, pl. 73, figs. 11–15. Permian, Texas.
Lenticulina moniwaensis Asano, **9,** p. 32, text fig. 1. Miocene, Japan.
——— *sintikuensis* Nakamura, **251,** p. 137, pl. 11, fig. 1. Pliocene, Formosa.
——— sp. indet., Asano, **9,** p. 33, text fig. 4. Miocene, Java.
Lenticulinidae, fam. nov., Wedekind, **390,** p. 102. Upper Cretaceous. Includes the genus *Lenticulina* Lamarck, 1804.
Lepidocyclina (*Nephrolepidina*) *besaiensis* van Eek, **121,** p. 48, pl. 1, figs. 1–11; text figs. 3–5. Aquitanian-Burdigalian, south Sumatra.
——— (*Lepidocyclina*) *colei* Gravell and M. A. Hanna, **160,** p. 526, pl. 61, fig. 1; pl. 63, fig. 5; pl. 64, figs. 1–6. Upper Oligocene, Texas.
——— (*Eulepidina*) *ehilensis* Silvestri, **333,** p. 175, pl. 9, fig. 3; pl. 17, figs. 1–3; pl. 22, fig. 5. Middle Oligocene and lower Miocene, north Somalia.
——— ——— *elephantina* (Munier-Chalmas, 1891) var. *convoluta* Silvestri, **303,** p. 183, pl. 6, fig. 6; pl. 14, fig. 1; pl. 19, fig. 1. Lower Miocene, north Somalia.
——— ——— *eumarginata* Silvestri, **333,** p. 174, pl. 17, figs. 4, 5; pl. 22, fig. 6. Middle Oligocene, north Somalia.
——— (*Nephrolepidina*) *fragilis* Cushman, 1920, var. *cubensis* Thiadens, **361,** p. 104, pl. 17, fig. 6; pl. 18, fig. 7. Transitional beds between Upper Eocene and lower Oligocene, Cuba.
——— (*Eulepidina*) *gigas* Cushman, 1919, var. *flexuosa* Silvestri, **333,** p. 185, pl. 18, fig. 3; pl. 19, fig. 6; pl. 20, figs. 4, 5. Middle Oligocene and lower Miocene, north Somalia. (Note: The varietal name is preoccupied by *Lepidocyclina flexuosa* L. Rutten, 1911, Samml. geol. Reichs-Mus. Leiden (1), vol. 9, p. 304, pl. 23, figs. 6–8.)
——— ——— ——— ——— var. *pumilia* Silvestri, **333,** p. 186, pl. 6, fig. 5; pl. 13, fig. 1; pl. 15, figs. 7, 8; pl. 22, fig. 4. Middle Oligocene and lower Miocene, north Somalia.
——— (*Nephrolepidina*) *marginata* (Michelotti, 1841) var. *nummulitoides* Silvestri, **333,** p. 173, pl. 13, fig. 3. Middle Oligocene, north Somalia.
——— (*Eulepidina*) *petri* Thiadens, **361,** p. 107, pl. 18, figs. 1, 5; pl. 19, fig. 5. Oligocene, Cuba. (Note: The specific designation is preoccupied by *Lepidocyclina* (*Nephrolepidina*) *petri* M. G. Rutten, 1935, Jour. Paleontology, vol. 9, p. 539.)
——— (*Polylepidina*) *punjabensis* L. M. Davies, **101,** p. 53, pl. 7, figs. 1–8; 14, 16; text fig. 3. Eocene, Punjab. [For: *Lepidorbitoides tibetica* H. Douvillé, 1916, pro parte, Paleontologia Indica, n.s., vol. 5, pt. 3, p. 34, pl. 14, figs. 2a–3b(?).]
——— (*Lepidocyclina*) *texana* Gravell and M. A. Hanna, **160,** p. 527, pl. 65, figs. 1–7. Upper Oligocene, Texas.
——— ——— *tschoppi* Thiadens, **361,** p. 103, text fig. 3-H; pl. 17, figs. 1, 3; pl. 18, fig. 6. Transitional beds between Upper Eocene and lower Oligocene, Cuba.
——— *zuffardii* Silvestri, **333,** p. 199, pl. 13, fig. 6; pl. 20, figs. 10, 11. Middle Oligocene, north Somalia.
Lepidorbitoides (*Lepidorbitoides*) *macgillavryi* Thiadens, **361,** p. 101, text figs. 2-A, 2-B, 3-K; pl. 16, fig. 9; pl. 17, fig. 7; pl. 19, fig. 4. Upper Cretaceous, Cuba.
——— ——— *palmeri* Thiadens, **361,** p. 101, text figs. 2-A, 2-B; pl. 17, figs. 2, 9, 10. Upper Cretaceous, Cuba.
——— ——— *rutteni* Thiadens, **361,** p. 100, text figs. 2-A, 2-B, 3-F, 3-J; pl. 15, figs. 5, 8, 9; pl. 17, fig. 5; pl. 19, fig. 8; Upper Cretaceous, Cuba.
——— ——— ——— ——— var. *armata* Thiadens, **361,** p. 101, text figs. 2-A, 2-B, 3-G, 3-*L*; pl. 16, fig. 6. Upper Cretaceous, Cuba.
Liebusella baylesi Coryell and Embich, **73,** p. 295, pl. 41, fig. 11. Upper Eocene, Panama.
Lingulina cubensis Cushman and Bermúdez, **85,** p. 11, pl. 1, fig. 38. Eocene, Cuba.
——— *pupa* (Terquem, 1866) forma A, Bartenstein and Brand, **26,** p. 152, pl. 4, fig. 53; pl. 5, fig. 33. Liassic, northwest Germany. [For: *Frondicularia pupa* Terquem and Berthelin,

1875, Mém. Soc. géol. France, (2), vol. 10 pl. 3, figs. 1a, b (non fig. 1, c–o).]

Listerella anconensis Coryell and Embich, **73,** p. 295, pl. 41, fig. 12. Upper Eocene, Panama.

——— *caribaea* Cushman and Bermúdez, **85,** p. 6, pl. 1, figs. 29, 30. Eocene, Cuba.

——— *cubana* Cushman and Bermúdez, **85,** p. 5, pl. 1, figs. 22, 23. Eocene, Cuba.

——— *gracillima* Cushman and Bermúdez, **85,** p. 6, pl. 1, figs. 27, 28. Eocene, Cuba. (Note: Specific designation preoccupied by *Listerella communiss* (d'Orbigny, 1826) var. *gracillima* Cushman, 1936, Cushman Lab. Foram. Res., Spec. Publ. 6, p. 40, pl. 6, fig. 9.)

——— *petrosa* Cushman and Bermúdez, **85,** p. 5, pl. 1, figs. 24–26. Eocene, Cuba.

Lituonella sp.?, Cushman, **82,** p. 185, pl. 22, fig. 14. Middle Eocene, Florida.

Lituotuba sp., Bartenstein, **25,** p. 337, text figs 5a, b. Middle Devonian, Eifel, Germany.

Loftusia elongata P. T. Cox, **74,** p. 443, pl. 33, fig. 2; pl. 35, figs. 1, 2; text fig. 4. Upper Cretaceous, Iran.

——— *harrisoni* P. T. Cox, **74,** p. 447, pl. 33, fig. 4; pl. 36, figs. 4–6. Upper Cretaceous, Iran.

——— *minor* P. T. Cox, **74,** p. 446, pl. 33, fig. 5; pl. 36, figs. 1–3. Upper Cretaceous, Iran.

Loxostoma indopacifica Yabe and Asano, **400,** p. 122, pl. 17, fig. 10. Pliocene, west Java.

Marginulina austinana Cushman, **78,** p. 92, pl. 13, figs. 1–4. Upper Cretaceous, Texas.

——— ——— ——— var. *acescens* Cushman, **78,** p. 93, pl. 13, fig. 9. Upper Cretaceous, Texas.

——— ——— ——— var. *directa* Cushman, **78,** p. 93, pl. 13, figs. 5–8. Upper Cretaceous, Texas.

——— *cretacea* Cushman, **78,** p. 94, pl. 13, figs. 12–15. Upper Cretaceous, Texas.

——— *dorsata* Cushman, **78,** p. 94, pl. 13, figs. 16–18. Upper Cretaceous, Texas.

——— *havanensis* Cushman and Bermúdez, **85,** p. 9, pl. 1, figs. 31, 32. Eocene, Cuba.

——— *howei* Garrett and Ellis, **145,** p. 631, pl. 86, figs. 8, 9, 18. Oligocene, Louisiana.

——— *idiomorpha* Garrett and Ellis, **145,** p. 631, pl. 86, figs. 5, 6, 13, 14. Oligocene, Texas.

——— *laeviuscula* Cushman and Bermúdez, **85,** p. 10, pl. 1, figs. 33, 34. Eocene, Cuba.

——— *mexicana* Cushman, 1925, var. *vaginata* Garrett and Ellis, **145,** p. 630, pl. 86, figs. 2, 10–12, 17. Oligocene, Texas.

——— *navarroana* Cushman, **78,** p. 98, pl. 14, figs. 17, 18. Upper Cretaceous, Alabama.

——— *palmerae* Cushman and Bermúdez, **85,** p. 10, pl. 1, figs. 36, 37. Eocene, Cuba.

——— *plummerae* Cushman, **78,** p. 97, pl. 13, figs. 21–23. Upper Cretaceous, Texas. [For: *Hemicristellaria ensis* Plummer, 1931 (non Reuss 1845–46, *Marginulina*), Univ. Texas Bull. 3101, p. 146, pl. 10, figs. 1–4; and for *Cristellaria lineara* Carsey, 1926 (non Reuss, 1862), Univ. Texas Bull. 2612, p. 36, pl. 2, fig. 3.]

——— *pseudomarcki* Cushman, **78,** p. 94, pl. 13, figs. 19, 20. Upper Cretaceous, Texas.

——— *sendaiensis* Asano, **9,** p. 33, text fig. 6. Miocene, Japan.

——— *stephensoni* Cushman, **78,** p. 93, pl. 13, figs. 10, 11. Upper Cretaceous, Texas.

——— *taylorana* Cushman, **78,** p. 96, pl. 14, fig. 7. Upper Cretaceous, Texas.

——— *texana* Cushman, **78,** p. 95, pl. 14, figs. 1–4. Upper Cretaceous Texas. (Note: The specific designation is preoccupied by Garrett and Ellis, 1937, ut infra, by two days. Their *Marginulina texana* was published on December 8, 1937, and Cushman's name appeared on December 10, 1937. Cushman has, therefore, changed his form to *Marginulina texasensis*, nom. nov., 1938.)

——— *texana* Garret and Ellis, **145,** p. 632, pl. 86, figs. 1, 3, 7. Oligocene, Texas.

——— *triangularis* d'Orbigny, 1846, var. *panamensis* Coryell and Embich, **73,** p. 297, pl. 42, fig. 1. Upper Eocene, Panama.

——— *trinitatensis* Cushman, **78,** p. 99, pl. 14, fig. 16. Upper Cretaceous, Trinidad. [For: *Marginulina jonesi* Cushman and Jarvis, 1932 (non Reuss, 1863), Proc. U. S. Nat. Mus., vol. 80, art. 14, p. 27, pl. 9, fig. 1.]

——— *wallacei* Hedberg, **176,** p. 670, pl. 40, figs. 15–17. Upper Oligocene, northeast Venezuela. [For: *Cristellaria subaculeata* Cushman, 1923, var. *glabrata* Nuttall, 1928 (non var. *glabrata* Cushman, 1923), Quart. Jour. Geol. Soc. London, vol. 84, p. 90, pl. 6, figs. 1, 5.]

Marginulinella, gen. nov., Wedekind, **390,** p. 94. (pl. 14, figs. 30–32). Fam. Marginulinellidae. Genotype: *Nautilus* (*Orthoceras*) *costatus* Batsch, 1791. Lower Jurassic.

Marginulinellidae, fam. nov., Wedekind, **390,** p. 94. Jurassic. Comprises the genera: *Marginulinella, Dentalinella, Pseudovaginulina, Saccularia* and *Planularia.*

Marginulinidae, fam. nov., Wedekind, **390,** p. 99. Middle and Upper Cretaceous. Comprises the genera: *Marginulina, Saracenaria,* and *Sacculariella.*

Marginulinopsis calva Thalmann, **357,** p. 348, pl. 22, fig. 6. Jurassic, Ukraine, Russia.

——— *decurse-costata* Thalmann, **357,** p. 348, pl. 22, fig. 1. Upper Cretaceous, California. [For: *Marginulina jonesi* Cushman and Church, 1929 (non Reuss, 1863), Proc. California Acad. Sci., (4), vol. 18, p. 507, pl. 38, figs. 7–9.]

——— *densicostata* Thalmann, **357,** p. 348, pl. 21, fig. 2. Recent, Culebra Island, 390 fathoms. [For: *Marginulina costata* (Batsch, 1791) in Brady, 1884, Challenger Report, p. 528, pl. 65, figs. 11, 12 (non figs. 10, 13.)]

——— *infracompressa* Thalmann, **357,** p. 348, pl. 23, fig. 2. Eocene, France. [For: *Marginulina behmi* Halkyard, 1919, (non *Cristellaria behmi* Reuss, 1865), Mem. Proc. Lit. Phil. Soc. Manchester, vol. 62, p. 85, pl. 5, fig. 4, (non fig. 3).]

Marsipella dextrospiralis Chapman and Parr, **58,** p. 166, pl. 10, fig. 48. Recent, Antarctic, 675 fathoms.

Massilina bantamensis Yabe and Asano, **400,** p. 116, pl. 17, fig. 7. Pliocene, west Java.

——— *texasensis* Cushman, **79,** p. 100, pl. 15, figs. 2, 3. Upper Cretaceous, Texas.

Miogypsina (*Miogypsina*) *cushmani* Vaughan, 1924, var. *subtilis* Tan, **345,** p. 97, pl. 1, fig. 16; pl. 3, figs. 15–18. Miocene, west Java.

——— (*Miolepidocyclina*) *excentrica* Tan, **344,** p. 40, pl. 1, fig. 12; pl. 2, figs. 1–7, ?8; pl. 3, figs. 1–9. Upper Aquitanian, Madura.

——— (*Miogypsina*) *kotoi* Hanzawa, 1931, var. *bispiralis* Tan, **344,** p. 37, pl. 1, figs. 5–7; pl. 2, fig. 14. Upper Aquitanian, Madura.

——— ——— ——— ——— var. *digitata* Tan, **345,** p. 101, pl. 2, figs. 1–5. Miocene, cast Borneo and south Sumatra.

——— sp. indet., Henson, **180,** p. 54, pl. 4, fig. 6; pl. 5, fig. 8; text fig. 5. Lower Miocene, Turkish Syria.

Multilepidina, subgen. nov., Silvestri, **333,** p. 160. No. subgenotype: given. Proposed for dicoidal and lenticular *Lepidocyclinae* with pluri-locular embryonal apparatus. This new subgenus, which is preoccupied by Hanzawa, 1932, is intended to replace the subgenus *Pliolepidina* H. Douvillé, 1915.

Neoalveolina melo (Fichtel and Moll, 1803) var. *curdica* Reichel, **291,** p. 108, pl. 10, figs. 4–7. Miocene, Armenian Taurus.

——— *pygmaea* (Hanzawa, 1930) var. *schlumbergeri* Reichel, **291,** p. 110, pl. 10, figs. 1–3; pl. 9, fig. 6-b. [For: *Alveolina boscii* Defrance, in Mobius, 1880, Mauritius und Seychellen, p. 79, pl. 3, fig. 1; and for: *Alveolina longa* Czjzek, in Egger, 1893, Abh. k. bayer. Akad. Wiss., vol. 18, p. 249, pl. 3, fig. 32.] Recent, off northwestern Madagascar.

Nephrolepidina praesondaica David-Sylvain, **100,** p. 15, pl. 2, fig. 11. Aquitanian and Burdigalian, Umbria, Italy.

Nodobacullariella, gen. nov., Cushman and Hanzawa, **90,** p. 41. Genotype: *N. japonica* Cushman and Hanzawa, 1937. Tertiary to Recent.

——— *atlantica* Cushman & Hanzawa, **90,** p. 42, pl. 5, figs. 7, 8. Recent, Atlantic, eastern coast of U.S.A., 104 fathoms.

——— *japonica* Cushman and Hanzawa, **90,** p. 42, pl. 5, figs. 9–11. Plio-Pleistocene, Ryukyu Islands, Japan.

Nodogenerina challengeriana Thalmann, **354,** p. 341. Recent. [For: *Nodosaria perversa* Schwager in Brady, 1884, Challenger Rept., p. 512, pl. 64, figs. 25–27.]

——— *havanensis* Cushman and Bermudez, **85,** p. 14, pl. 1, figs. 47, 48. Eocene, Cuba.

——— *jedlitschkai* Thalmann, **354,** p. 341. Recent. [For: *Nodosaria radicula* (Linné, 1767) var. *annulata* (Terquem et Berthelin, 1875) in Brady, 1884, Challenger Rept., p. 496, pl. 62, figs. 1, 2.]

——— *laevis* Cushman and Bermúdez, **85,** p. 15, pl. 2, fig. 12. Eocene, Cuba.

Nodosarella acus Cushman and Bermúdez, **85,** p. 19, pl. 2, figs. 10, 11. Eocene, Cuba.

——— *constricta* Cushman and Bermúdez, **85,** p. 18, pl. 2, figs. 4–7. Eocene, Cuba.

Nodosaria metensis Terquem, 1863, forma A, Bartenstein and Brand, **26,** p. 146, pl. 1-A, fig. 10. Liassic alpha and beta, northwest-Germany. [For: *Nodosaria hortensis* Issler, 1908 (non Terquem, 1866), Palaeontographica, vol. 55, p. 50, pl. 2, figs. 67–71.]

——— *navarroana* Cushman, **79,** p. 103, pl. 15, fig. 11. Upper Cretaceous, Texas.

——— *nitidana* Brand, in Bartenstein and Brand, **26,** p. 143, pl. 2-b, fig. 22; pl. 4, fig. 32; pl. 5, fig. 27. Liassic alpha to zeta, northwest-Germany.

——— *nuttalli* Hedberg, **176,** p. 673, pl. 91, fig. 6. Upper Oligocene, northeast Venezuela. [For: *Nodosaria* aff. *carinata* (Neugeboren) in Nuttall, 1932, Jour. Paleontology, vol.6—p. 16 pl. 3, fig. 11.]

——— *oculina* (Terquem and Berthelin, 1875) forma A, Bartenstein and Brand, **26,** p. 147, pl. 8, fig. 14. Liassic zeta and Dogger alpha, northwest Germany. [For: *Dentalina oculina* Terquem and Berthelin, 1875, Mém. Soc. géol. France, (2), vol. 10, p. 31, pl. 2, fig. 20-b (non figs. 20-a, 20-c); and for: *Dentalina vermicularis* Terquem, 1866, VI Mem. Foram. Lias, p. 483, pl. 19, fig. 21.]

——— *opalini* Bartenstein in Bartenstein and Brand, **26,** p. 147, pl. 8, fig. 13; Dogger alpha, northwest Germany.

——— *pariana* Hedberg, **176,** p. 672, pl. 91, fig. 5. Upper Oligocene, northeast Venezuela. [For: ?*Nodosaria longiscata* Guppy, 1904 (non d'Orbigny, 1846), Geol. Mag., (5), vol. 1, pl. 8, figs. 12, 13.]

——— *raphanistrum* (Linné, 1758) var. *caribbeana* Hedberg, **176,** p. 671, pl. 91, fig. 1. Upper Oligocene, northeast Venezuela. [For: ?*Nodosaria raphanistrum* Guppy, 1904 (non Linné, 1758), Geol. Mag., (5), vol. 1, p. 196, pl. 9, fig. 9; for: *Nodosaria raphanistrum* Nuttall, 1932, (non Linné, 1758), Jour. Paleont., vol. 6, p. 16, pl. 3, fig. 10; and for: ?*Nodosaria* sp., Nuttall, 1928, Quart. Jour. Geol. Soc. London, vol. 84, p. 84, pl. 4, fig. 22.]

——— sp., Silvestri, **333,** p. 99, pl. 9, fig. 6. Miocene, north Somaliland.

——— sp. 3, Voorwijk, **384,** p. 191, pl. 1, fig. 1. Upper Cretaceous, Cuba.

——— *wataseii* Yabe and Asano, **400,** p. 101, pl. 18, fig. 6. Miocene, west Java.

Nodosariella, gen. nov., Wedekind, **390,** p. 93. (pl. 14, figs. 14–16). Genotype: *Nautilus raphanus* Linné, 1758. Fam. Nodosariellidae. Lower Jurassic. (Cave: *Nodosarella* Rzehak, 1885!)

Nodosariellidae, fam. nov., Wedekind, **390,** p. 93. Comprises the genera *Nodosariella, Ichthyolaria,* and *Plectofrondicularia.* Jurassic.

Nonion communis (d'Orbigny, 1826) var. *decorata* Jedlitschka, **188,** p. 39, pl. 2, fig. 4. Tortonian, Czechoslovakia.

——— *havanense* Cushman and Bermúdez, **85,** p. 19, pl. 2, figs. 13, 14. Eocene, Cuba.

Nummularia, gen. nov., Wedekind, **390,** p. 111 (pl. 15, figs. 50–54). Fam. Nummulariidae Genotype: *Nummularia* sp., Wedekind, 1937. Middle Cretaceous. Preoccupied by Sowerby, 1826.

——— sp., Wedekind, **390,** p. 111, pl. 15, fig. 15. Middle Cretaceous, Germany. (Note: This unnamed species serves as genotype.)

Nummulariidae, fam. nov., Wedekind, **390,** p. 111. Genus: *Nummularia* Wedekind, 1937, (non Sowerby, 1826). Gault.

Nummulites lahirii L. M. Davies, **101,** p. 25, pl. 3, figs. 12–15. Eocene, Punjab, India.

——— *rectus* Curry, **77,** p. 241, pl. 20, figs. 1–3; pl. 21, fig. 11. Lower Bartonian, England.

——— sp. 1, Caudri, **56,** p. 406, pl. 30, figs. 1-a, 2, 3-a, 4. Lower Lutetian, Swiss Alps.

——— sp. 2, Caudri, **56,** p. 407, pl. 30, figs. 1, 3-b. Lower Lutetian, Swiss Alps.

——— sp. 3, Caudri, **56,** p. 407, pl. 30, fig. 5; pl. 31, figs. 1, 2. Lower Lutetian, Swiss Alps.

Operculina alpina H. Douvillé, 1916, var. *multiseptata* Silvestri, **332,** p. 205, pl. 9, figs. 1–4. Lower Eocene, Tripolitania. Preoccupied by *Operculina bartschi* Cushman var. *multiseptata* Yabe and Hanzawa, 1930, Sci. Rept. Tohoku Imp. Univ., series 2, (Geol.), vol. 14, p. 39, pl. 2, figs. 6, 7; pl. 15; pl. 16, fig. 1 (Burdigalian, Formosa).

——— *jiiwani* L. M. Davies, **101,** p. 39, pl. 5, figs. 11–14, 16. Eocene, Punjab, India.

——— *madagascariensis* d'Orbigny, 1826, var. *costulato-granulosa* Silvestri, **333,** p. 108, pl.14, fig. 2. Lower Miocene, northern Somalia.

——— *patalensis* L. M. Davies, **101,** p. 38, pl. 5, figs. 6, 17–19, 26. Eocene, Punjab, India.

——— *salsa* L. M. Davies, **101,** p. 37, pl. 5, figs. 1, 3, 7, 10, 15. Eocene, Punjab, India.

——— sp., Durham, **117,** p. 367, text fig. 1. Upper Eocene or Lower Oligocene, Washington.

——— *subsalsa* L. M. Davies, **101,** p. 37, pl. 5, figs. 2, 4, 8, 9. Eocene, Punjab, India.

Operculinoides ellisorae Gravell and M. A. Hanna, **160,** p. 522, pl. 60, figs. 1–6. Upper Oligocene, Texas.

——— *howei* Gravell and M. A. Hanna, **160,** p. 523, pl. 61, figs. 2–6. Upper Oligocene, Texas.

Orbiculininae, subfam. nov., Wedekind, **390,** p. 126. Fam. Orthophragminidae Wedekind, 1937. Comprises only the genus *Orbiculina* Lamarck, 1816. Miocene to Recent.

Orbitolina birmanica Sahni, **310,** p. 365, pl. 29, figs. 1–7; pl. 30, figs. 1–19; text figs. 1-c to 1-g. Lower Cretaceous, Burma.

Orbitolitidae, fam. nov., Wedekind, **390,** p. 123. comprises the genera *Orbitolites*, *Lepidocyclina*, and *Orbitoides*. Upper Cretaceous to Miocene.

Orobias tingi Lee, **215,** p. 78, pl. 2, fig. 4. Carboniferous, Donetz Basin, Russia.

Orthophragminidae, fam. nov., Wedekind, **390,** p. 123. Comprises the genera *Orthophragmina*, *Praesorites*, *Cycloclypeus*, *Spiroclypeus*, and *Heterostegina*. Upper Cretaceous to Recent.

Orthophragmininae, subfam. nov., Wedekind, **390,** p. 125. Fam. Orthophragminidae Wedekind, 1937. Comprises the genera *Praesorites* and *Orthophragmina*. Upper Cretaceous to Lower Oligocene.

Ordovicina, gen. nov., Eisenack, **122,** p. 234. Fam. Astrorhizidae. Genotype: *O. oligostoma* Eisenack, 1937. Silurian.

——— *oligostoma* Eisenack, **122,** p. 234, pl. 15, figs. 24–26. Silurian, Baltic provinces.

Ozawainella delawarensis Dunbar and Skinner, **116,** p. 602, pl. 46, figs. 21–26. Permian, Texas.

——— *hueconensis* Dunbar and Skinner, **116,** p. 601, pl. 45, figs. 16–25. Permian, Texas.

——— sp., Needham, **253,** p. 20, pl. 2, fig. 3. Pennsylvanian, New Mexico.

——— sp., Thompson and Foster, **365,** p. 133, pl. 24, figs. 6–8. Middle Permian, Szechuan, China.

Ozawainellinae, subfam. nov., Thompson and Foster, **365,** p. 132. Fam. Fusulinidae. Comprises the genus *Ozawainella* Thompson, 1935. Permian.

Parafusulina bakeri Dunbar and Skinner, **116,** p. 677, pl. 71, figs. 1–10. Permian, Texas.

——— *bösei* Dunbar and Skinner, **116,** p. 679, pl. 73, figs. 1–9. Permian, Texas.

——— ——— ——— ——— var. *attenuata* Dunbar and Skinner, **116,** p. 680, pl. 74, figs. 5–13. Permian, Texas.

——— *diabloensis* Dunbar and Skinner, **116,** p. 674, pl. 60, figs. 8–11. Permian, Texas.

——— *dunbari* Needham, **253,** p. 56, pl. 11, figs. 5–11; pl. 12, figs. 1, 2. Middle Permian, New Mexico.

——— *fountaini* Dunbar and Skinner, **116,** p. 675, pl. 70, figs. 1–10. Permian, Texas.

——— *lineata* Dunbar and Skinner, **116,** p. 681, pl. 74, figs. 1–4. Permian, Texas.

——— *maleyi* Dunbar and Skinner, **116,** p. 686, pl. 77, figs. 1–12. Permian, Texas.

——— ——— ——— ——— var. *referta* Dunbar and Skinner, **116,** p. 687, pl. 77, figs. 13–18. Permian, Texas.

——— *schucherti* Dunbar and Skinner, **116,** p. 672, pl. 64, figs. 9–12. Permian, Texas.

——— *sellardsi* Dunbar and Skinner, **116,** p. 688, pl. 78, figs. 1–11. Permian, Texas.

——— *splendens* Dunbar and Skinner, **116,** p. 682, pl. 75, figs. 1–11; pl. 73, fig. 10. Permian, Texas.

Paraschwagerina acuminata Dunbar and Skinner, **116,** p. 671, pl. 54, figs. 1–5. Permian, Texas.

Paraspiroclypeus, gen. nov., Hanzawa, **169,** p. 116. Fam. Camerinidae. Genotype: *Camerina chawneri* Palmer, 1934, Mem. Soc. cubana Hist. Nat., vol. 8, p. 261, pl. 16, figs. 3, 6, 7. Upper Oligocene.

Pellatispirella, gen. nov., Hanzawa, **169,** p. 116. Fam. Pellatispiridae Hanzawa, 1937. Genotype: *Camerina matleyi* Vaughan, 1929, Jour. Paleontology, vol. 3, p. 376, pl. 39, figs. 2–7. Upper Cretaceous to Eocene.

——— *antillea* Hanzawa, **169,** p. 116, pl. 20, figs. 8–10; pl. 21, fig. 1. Eocene, Haiti.

——— sp., Hanzawa, **169,** p. 116, pl. 21, fig. 2. Eocene, Haiti.

Pellatispiridae, fam. nov., Hanzawa, **169,** p. 113. Comprises the genera *Pellatispira* and *Pellatispirella*. Upper Cretaceous to Eocene.

Perisphinctina, gen. nov., Wedekind, **390,** p. 105.

(pl. 16, figs. 9–11). Fam. Robulinidae Wedekind, 1937. Genotype: *Robulina pauperata* Reuss, 1851. Middle Oligocene. (Note: There is no *Robulina pauperata* published by Reuss.)

Pinaria, gen. nov., Bermúdez, **34,** p. 242. Fam. Ellipsoidinidae. Genotype: *P. heterosculpta* Bermúdez, 1937. Upper Eocene, Cuba.

——— *heterosculpta* Bermúdez, **34,** p. 242, pl. 21, figs. 1, 2. Upper Eocene, Cuba.

Planularia cubensis Bermúdez, **31,** p. 141, pl. 17, fig. 12. Eocene, Cuba.

——— *magnifica* Thalmann, 1933, var. *falciformis* Thalmann, **354,** p. 342. Recent. New name for *P. magnifica* Thalmann var. *elongata* Thalmann, 1933, Eclogae geol. Helvetiae, vol. 26, p. 255.

——— sp., Thiadens, **361,** p. 94, pl. 16, figs. 2, 3. Oligocene, Cuba.

——— *umbonata* Loetterle, **223,** p. 23, pl. 2, fig. 2. Upper Cretaceous, Nebraska.

——— *venezuelana* Hedberg, **176,** p. 670, pl. 90, fig. 14. Upper Oligocene, Venezuela.

Planulina camagueyana Bermúdez, **31,** p. 148, pl. 18, fig. 13; pl. 19, fig. 1. Eocene, Cuba.

——— *hoppensis* Nakamura, **251,** p. 142, pl. 12, fig. 8. Pliocene, Formosa.

——— *jabacoensis* Bermúdez, **34,** p. 246, pl. 21, figs. 10, 11. Eocene, Cuba.

——— *leoni* Bermúdez, **31,** p. 148, pl. 18, figs. 8–10. Eocene, Cuba.

——— *simplex* Cushman and Bermúdez, **85,** p. 28, pl. 2, figs. 45–47. Eocene, Cuba.

——— *suturata* Cushman and Bermúdez, **85,** p. 29, pl. 2, figs. 54–56. Eocene, Cuba.

Plectina sp.?, Cushman, **82,** p. 110, pl. 12, fig. 21. Miocene, Bulgaria.

Plectofrondicularia herrerae Bermúdez, **34,** p. 240, pl. 20, fig. 7. Eocene, Cuba.

——— *lirata* Bermúdez, **34,** p. 240, pl. 20, fig. 6. Eocene, Cuba.

——— *variabilis* Ovey, **263,** p. 121, text figs. 10, 11. Oligocene (?), Cyprus.

Pleurostomella alazanensis Cushman, 1925, var. *cubensis* Cushman and Bermúdez, **85,** p. 17, pl. 1, figs. 64, 65. Eocene, Cuba.

——— *naranjoensis* Cushman and Bermúdez, **85,** p. 16, pl. 1, figs. 59, 60. Eocene, Cuba.

——— *obesa* Cushman and Bermúdez, **85,** p. 16, pl. 1, fig. 61. Eocene, Cuba.

——— *palmerae* Bermúdez, **34,** p. 241, pl. 20, figs. 8, 9. Eocene, Cuba.

——— *rimosa* Cushman and Bermúdez, **85,** p. 17, pl. 1, figs. 62, 63. Eocene, Cuba.

Polydiexodina guadalupensis Needham, **253,** p. 58, pl. 12, figs. 3–7. Upper Permian, New Mexico.

———? *rotundata* Dunbar and Skinner, **116,** p. 697, pl. 81, figs. 1, 2. Permian, Texas.

Polymorphina myrae Parr and Collins, **268,** p. 203, pl. 15, fig. 4. Lower Pliocene, Victoria, Australia.

——— *yabei* Asano, **9,** p. 33, text fig. 5. Miocene, Japan.

Proteonina bulbosa Chapman and Parr, **58,** p. 150, pl. 10, fig. 42. Recent, Antarctic, 358 fathoms.

——— *difflugiformis* (H. B. Brady, 1879) var. *limnetica* Hada, **163,** p. 342, text fig. 2. Brackish water, Hachiró-gata, Japan.

Psammatodendron? glauconiticum Eisenack, **122,** p. 234, pl. 16, fig. 13; text fig. 8. Silurian, Baltic provinces.

Pseudofrondicularia, gen. nov., Wedekind, **390,** p. 94 (pl. 14, figs. 20, 21). Fam. Nodosariellidae Wedekind, 1937. Genotype: *Frondicularia carinata* Burbach, 1886, Zeitschr. Naturwiss. Halle, vol. 59, p. 47, pl. 1, figs. 17–20, 29. Jurassic.

Pseudofusulina jaroslavkensis Vissarionova, **382,** p. 13, pl. 2, figs. 2, 3, 5. Uralian, Carboniferous, Sterlitamak, Russia.

——— *paraverneuili* Vissarionova, **382,** p. 11, pl. 1, figs. 5–7; pl. 2, fig. 1. Uralian, Carboniferous, Sterlitamak, Russia.

——— *schellwieni* Vissarionova, **382,** p. 16. [For: *Fusulina verneuili* Schellwien, 1908 (non v. Möller, 1878) Palaeontographica, vol. 55, p. 174, pl. 16, fig. 10 (non fig. 11) (non pl. 17, figs. 1, 4–6).] Carboniferous, Russia.

——— *tastubensis* Vissarionova, **382,** p. 14, pl. 2, figs. 4, 6, 7. Uralian, Carboniferous, Sterlitimak, Russia.

——— *verneuili* (v. Möller, 1878) var. *infecta* Vissarionova, **382,** p. 10, pl. 1, fig. 4. Uralian, Carboniferous, Sterlitamak, Russia.

Pseudoglandulina sp., Kalinin, **194,** p. 31, pl. 4, fig. 44. Upper Cretaceous, Aktiubinsk, Russia.

Pseudolepidina, gen. nov., Barker and Grimsdale, **21,** p. 169. No family given. Genotype: *P. trimera* Barker and Grimsdale, 1937. Basal Middle Eocene.

——— *trimera* Barker and Grimsdale, **21,** p. 172, pl. 5, figs. 1–3; pl. 8, figs. 1–5. Basal Middle Eocene, Mexico.

Pseudonummulites, gen. nov., Silvestri, **330,** p. 149. Fam. Rotaliidae; subfam. Amphistegininae. Genotype: *Nummulina radiata* d'Orbigny, 1846, Foram. Foss. Vienne, p. 115, pl. 5, figs. 23, 24. Eocene to Pliocene.

Pseudopolymorphina doanei (Galloway and Wissler, 1927) var. *beaumarisensis* Parr and Collins, **268,** p. 200, pl. 14, fig. 3. Lower Pliocene, Victoria, Australia.

——— *taiwanica* Nakamura, **251,** p. 138, pl. 11, fig. 4. Pliocene, Formosa.

——— *tasmanica* Parr and Collins, **268,** p. 200, pl. 14, fig. 6. Lower Miocene, Tasmania.

Pseudoschwagerina aequalis F. and G. Kahler, **192,** p. 19, pl. 1, figs. 9, 10. Lower Permian, Carnic Alps.

——— *beedei* Dunbar and Skinner, **116,** p. 656, pl. 49, figs. 1–14. Permian, Texas.

——— *carniolica* F. and G. Kahler, **192,** p. 39, pl. 3, figs. 3–6. Lower Permian, Carnic Alps.

——— *confinii* F. and G. Kahler, **192,** p. 15, pl. 1, figs. 3, 4. Lower Permian, Carnic Alps.

——— *extensa* F. and G. Kahler, **192,** p. 17, pl. 1, figs. 7, 8. Lower Permian, Carnic Alps.

——— *gerontica* Dunbar and Skinner, **116,** p. 660, pl. 51, figs. 1–6. Permian, Texas.

——— (*Zellia*) *heritschi* F. and G. Kahler, 1937, var. *colanii* F. and G. Kahler, **192,** p. 31, pl. 2, figs. 10, 11. Lower Permian, Carnic Alps.

——— ——— ——— ——— ——— var. *elatior*

F. and G. Kahler, **192,** p. 30, pl. 2, figs. 8, 9. Lower Permian, Carnic Alps.

——— ——— ——— ——— ——— var. *heritschi* F. and G. Kahler, **192,** p. 24, pl. 2, figs. 1–3. Subgenotype: of *Zellia*, subgen. nov., F. and G. Kahler, 1937. Lower Permian, Carnic Alps.

——— ——— ——— ——— ——— var. *media* F. and G. Kahler, **192,** p. 29, pl. 2, figs. 6, 7. Lower Permian, Carnic Alps.

——— ——— ——— ——— ——— var. *mira* F. and G. Kahler, **192,** p. 33, pl. 3, figs. 7, 8. Lower Permian, Carnic Alps.

——— *morsei* Needham, **253,** p. 54, pl. 10, figs. 5–7. Lower Permian, New Mexico.

——— *nitida* F. and G. Kahler, **192,** p. 14, pl. 1, figs. 1, 2. Lower Permian, Carnic Alps.

——— *orientale* Huzimoto, **185,** p. 123, pl. 7, figs. 17–21. Uralian, Japan. [For: *Schwagerina princeps* Deprat, 1912, Mém. Serv. géol. Indochine, vol. 1, no. 3, p. 37, pl. 1, figs. 1–3; and for: *Schwagerina princeps* Chen, 1934, Paleontologia Sinica, series B, vol. 4, no. 2, p. 96, pl. 15, figs. 1–4.]

——— *pulchra* F. and G. Kahler, **192,** p. 36, pl. 3, figs. 1, 2. Lower Permian, Carnic Alps.

——— *texana* Dunbar and Skinner, **116,** p. 662, pl. 52, figs. 1–8; pl. 53, fig. 9. Permian, Texas. [For: *Schwagerina fusulinoides* Beede and Kniker, 1924 (non Schellwien, 1892), Univ. Texas Bull. 2433, p. 19, pl. 1, fig. 4; pl. 3, figs. 1–4, 8; pl. 7, figs. 1–3.]

——— ——— ——— ——— ——— var. *ultima* Dunbar and Skinner, **116,** p. 665, pl. 53, figs. 6, 7, 10. Permian, Texas.

——— *turbida* F. and G. Kahler, **192,** p. 16, pl. 1, figs. 15, 16. Lower Permian, Carnic Alps.

Pseudouvigerina selseyensis (Heron-Allen and Earland, 1909) var. *sculpta* Glaessner, **151,** p. 373, pl. 2, fig. 20. Lower Eocene, Caucasus, Russia.

Pseudovaginulina, gen. nov., Wedekind, **390,** p. 95 (pl. 14, figs. 2–4). Fam. Marginulinellidae Wedekind, 1937. Genotype: *P. oxyacantha* Wedekind, 1937. Lower and middle Jurassic.

——— *oxyacantha* Wedekind, **390,** p. 95, pl. 14, fig. 2. Liassic, Germany.

Pullenia inflata Weber, **388,** p. 37, text fig. 1. Lower Miocene, Germany.

Pulvinulina sp., Silvestri, **333,** p. 146, pl. 6, fig. 2. Middle Miocene, northern Somalia.

Pulvinulinella nobilis Bermúdez, **31,** p. 147, pl. 18, figs. 6, 7. Eocene, Cuba.

——— *nodosa* Bermúdez, **31,** p. 147, pl. 18, figs. 11, 12. Eocene, Cuba.

Pyrgo siogamensis Asano, **13,** p. 114, pl. 15, fig. 3. Recent, Siogama, Japan.

Pyrulina crespinae Parr and Collins, **268,** p. 198, pl. 14, fig. 1. Lower Pliocene, Victoria, Australia.

Quinqueloculina costai Silvestri, **333,** p. 79, pl. 6, fig. 2. Middle Miocene, northern Somalia. [For: *Quinqueloculina lobata* Silvestri, 1927 (non Costa, 1856), Ann. R. Liceo sci. Milano, 1926–27, p. 332, pl. 3, fig. 8.]

——— *javana* Yabe and Asano, **400,** p. 98, pl. 18, fig. 4. Miocene, west Java.

——— *moremani* Cushman, **19,** p. 100, pl. 15, fig. 1. Upper Cretaceous, Texas. [For: *Quinqueloculina stelligera* Moreman, 1927 (non Schlumberger, 1893), Jour. Paleontology, vol. 1, p. 100, pl. 16, figs. 11, 12.]

——— *reticulata* (d'Orbigny, 1826) var. *chitanii* Yabe and Asano, **400,** p. 114, pl. 17, fig. 8. Pliocene, Bantam, west Java.

——— *tikutoensis* Nakamura, **251,** p. 136, pl. 10, fig. 11. Pliocene, Formosa.

Reophax colonensis Coryell and Embich, **73,** p. 293, pl. 41, figs. 2, 3. Upper Eocene, Panama.

——— *mawsoni* Chapman and Parr, **58,** p. 148, pl. 10, fig. 41. Recent, Antarctic, 370 fathoms.

——— *parsonensis* Coryell and Embich, **73,** p. 293, pl. 41, fig. 4. Upper Eocene, Panama.

Rhabdammina cylindrica Glaessner, **151,** p. 354, pl. 1, fig. 1. Paleocene, Caucasus, Russia. [For: *Rhabdammina linearis* Grzybowski, 1896 (non H. B. Brady, 1879), Rozpr. Akad. Umiej. Krakow, vol. 30, pl. 8, fig. 7.]

Rhizammina horrida Chapman and Parr, **58,** p. 165, pl. 10, fig. 47. Recent, Antarctic, 1660 fathoms.

——— sp., Bartenstein and Brand, **26,** p. 128, text fig. 14. Liassic alpha, northwest Germany.

Robulinidae, fam. nov., Wedekind, **390,** p. 104. Comprises the genera *Robulus, Gladiaria,* and *Perisphinctina*. Tertiary to Recent.

Robulus bataviaensis Yabe and Asano, **400,** p. 100, pl. 18, fig. 16. Miocene, west Java.

——— *chitanii* Yabe and Asano, **400,** p. 100, pl. 18, fig. 14. Miocene, west Java.

——— *costatus* (Fichtel and Moll, 1798) var. *bantarkasohensis* Yabe and Asano, **400,** p. 100, pl. 18, fig. 15. Miocene, west Java.

——— *hoppoensis* Nakamura, **251,** p. 137, pl. 11, fig. 2. Pliocene, Formosa.

——— *malonianus* Albritton, **5,** p. 21, pl. 4, figs. 5, 6. Upper Jurassic, Texas. [For: *Cristellaria osnabrügensis* Münster, 1838, var. *münsteri* Brückmann, 1904 (non Roemer, 1839), Schrift, Phys. Gesell. Königsberg, Jahrg. 45, p. 15, pl. 3, figs. 14–16.

——— *miyagiensis* Asano, **9,** p. 32, text fig. 3. Miocene, Japan.

——— *promamilligerus* Albritton, **5,** p. 20, pl. 4, figs. 1, 2. Upper Jurassic, Texas.

——— *terryi* Coryell and Embich, **73,** p. 299, pl. 41, fig. 17. Upper Eocene, Panama.

Rotalia calcariformis (Schwager, 1883) var. *pontica* Glaessner, **151,** p. 380, pl. 3, fig. 28. Lower Eocene, Caucasus, Russia.

——— *exsculpta* Reuss, 1860, var. *africana* Fahrion, **128,** p. 194, text figs. 1–3. Upper Cretaceous, Pemba Bay, Portuguese East Africa.

——— *hozanensis* Nakamura, **251** p. 141, pl. 12, fig. 4. Pliocene, Formosa.

——— *multispinosa* Nakamura, **251,** p. 141, pl. 12, fig. 5. Pliocene, Formosa.

——— *taiwanica* Nakamura, **251,** p. 141, pl. 12, fig. 6. Pliocene, Formosa.

——— *tikutoensis* Nakamura, **251,** p. 141, pl. 12, fig. 7. Pliocene, Formosa.

Rotaliatina globosa Yabe and Asano, **401,** p. 326, text fig. 3. Pliocene, Bantam, west Java.

Rugofusulina, gen. nov., Rauser-Cernoussova, **287,** p. 11 (21). Fam. Fusulinidae. Genotype: *Fusulina prisca* Ehrenberg, in Möller, 1878, Mat. Geol. Russl., vol. 8, p. 85, pl. 3, fig. 1; pl. 6, fig. 2. Upper Carboniferous.

——— *aktjubensis* Rauser-Cernoussova, **287,** p. 12, pl. 1, figs. 2, 3. Upper Carboniferous, southern Urals, Russia.

——— *devexa* Rauser-Cernoussova, **287,** p. 19, pl. 3, figs. 4–7. Upper Carboniferous, southern Urals, Russia.

——— *kargalensis* Rauser-Cernoussova, **287,** p. 18, pl. 3, figs. 1–3. Upper Carboniferous, southern Urals, Russia.

——— *latioralis* Rauser-Cernoussova, **287,** p. 15, pl. 2, figs. 3–6. Upper Carboniferous, southern Urals, Russia.

——— *moderata* Rauser-Cernoussova, **287,** p. 23, pl. 2, fig. 8. Upper Carboniferous, southern Urals, Russia.

——— *pulchella* Rauser-Cernoussova, **287,** p. 17, pl. 2, figs. 9, 10. Upper Carboniferous, southern Urals, Russia.

——— *ruzenzevi* Rauser-Cernoussova, **287,** p. 20, pl. 3, figs. 8–10. Upper Carboniferous, southern Urals, Russia.

——— *serrata* Rauser-Cernoussova, **287,** p. 13, pl. 1, figs. 4–6. Upper Carboniferous, southern Urals, Russia.

——— ——— ——— var. *transita* Rauser-Cernoussova, **287,** p. 14, pl. 2, figs. 1, 2. Upper Carboniferous, southern Urals, Russia.

——— ——— ——— var. *valens* Rauser-Cernoussova, **287,** p. 14, pl. 1, figs. 8, 9. Upper Carboniferous, southern Urals, Russia.

——— *stabilis* Rauser-Cernoussova, **287,** p. 13, pl. 1, fig. 7. Upper Carboniferous, southern Urals, Russia.

Ruttenia dariensis Coryell and Embich, **73,** p. 302, pl. 43, fig. 14. Upper Eocene, Panama.

Rzehakina venezuelana Hedberg, **176,** p. 669, pl. 90, fig. 12. Upper Oligocene, Venezuela.

Saccammina micrograna Eisenack, **122,** p. 233, pl. 16, fig. 11. Silurian, Baltic provinces.

——— *silurica* Eisenack, **122,** p. 233, pl. 16, fig. 10. Silurian, Baltic provinces.

Saccorhiza ramosa (H. B. Brady, 1879) var. *abyssalica* Stschedrina. Recent, Kara-Sea, Arctic Region. (Note: This variety was published during 1937 in a fascicule of the Trans. Arctic Inst. Leningrad; not seen by the compiler.)

Saccularia, gen. nov., Wedekind, **390,** p. 95 (pl. 14, figs. 33–36). Fam. Marginulinellidae Wedekind, 1937. Genotype: *Marginulina inaequistriata* Terquem, 1863, Mém. Acad. imp. Metz, vol. 44, p. 401, pl. 8, fig. 15a–f. Liassic and Dogger.

Sacculariella, gen. nov., Wedekind, **390,** p. 102 (pl. 15, figs. 27, 29, 64). Fam. Marginulinidae Wedekind, 1937. Genotype: *S. ensis* Wedekind, 1937. Middle and Upper Cretaceous.

——— *ensis* Wedekind, **390,** p. 102, pl. 15, fig. 27 (29?). Middle Cretaceous, Gault, Germany.

Sakesaria, gen. nov., L. M. Davies, **101,** p. 49. Fam. Nummulitidae; subfam. Rotalinae. Genotype: *S. cotteri* L. M. Davies, 1937. Eocene.

——— *cotteri* L. M. Davies, **101,** p. 49, pl. 7, figs. 18, 21–24, text fig. 2. Eocene, Punjab, India.

Saracenaria ornatula Cushman and Bermúdez, **85,** p. 11, pl. 1, fig. 35. Eocene, Cuba.

——— *senni* Hedberg, **176,** p. 674, pl. 90, fig. 18. Upper Oligocene, Venezuela.

Schubertella kingi Dunbar and Skinner, **116,** p. 610, pl. 45, figs. 10–15. Permian, Texas.

——— *melonica* Dunbar and Skinner, **116,** p. 611, pl. 57, figs. 10–14. Permian, Texas.

Schwagerina bellula Dunbar and Skinner, **116,** p. 643, pl. 63, figs. 8–18. Permian, Texas. (Note: According to a postscript on p. 699, this species is identical with *Schwagerina thompsoni* Needham, 1937, ut infra.)

——— *crassitectoria* Dunbar and Skinner, **116,** p. 641, pl. 65, figs. 1–15. Permian, Texas.

——— *diversiformis* Dunbar and Skinner, **116,** p. 647, pl. 60, figs. 1–7. Permian, Texas.

——— (?) *donetziana* Lee, **215,** p. 96, pl. 2, figs. 24–26. Carboniferous, Donetz Basin, Russia.

——— *emaciata* (Beede, 1916) var. *jarillaensis* Needham, **253,** p. 47, pl. 7, figs. 10, 11; pl. 8, figs. 1–4. Lower Permian, New Mexico.

——— *franklinensis* Dunbar and Skinner, **116,** p. 628, pl. 66, figs. 1–8. Permian, Texas.

——— *gracilitatis* Dunbar and Skinner, **116,** p. 635, pl. 62, figs. 1–11. Permian, Texas.

——— *guembeli* Dunbar and Skinner, **116,** p. 639, pl. 61, figs. 1–13. Permian, Texas.

——— ——— ——— ——— var. *pseudoregularis* Dunbar and Skinner, **116,** p. 640, pl. 61, figs. 14–24. Permian, Texas.

——— *hawkinsi* Dunbar and Skinner, **116,** p. 632, pl. 59, figs. 1–8; pl. 56, figs. 15, 16. Permian, Texas.

——— *hessensis* Dunbar and Skinner, **116,** p. 630, pl. 58, figs. 1–11, Permian, Texas.

——— *knighti* Dunbar and Skinner, **116,** p. 648, pl. 81, figs. 11–14. Permian, Texas.

——— *laxissima* Dunbar and Skinner, **116,** p. 652, pl. 68, figs. 1–11. Permian, Texas.

——— *linearis* Dunbar and Skinner, **116,** p. 637, pl. 62, figs. 12–15; pl. 63, figs. 1–7. Permian Texas.

——— *nelsoni* Dunbar and Skinner, **116,** p. 650, pl. 67, figs. 1–14. Permian, Texas.

——— *setum* Dunbar and Skinner, **116,** p. 654, pl. 59, figs. 1–11. Permian, Texas.

——— (*Pseudofusulina*) sp., Huzimoto, **186,** p. 237, text fig. 2. Uralian, Japan.

——— sp., Thompson and Foster, **365,** p. 134, pl. 25, fig. 1. Middle Permian, Szechuan, China.

——— *thompsoni* Needham, **253,** p. 50, pl. 8, figs. 7–10. Lower Permian, New Mexico. (Note: See also *Schwagerina bellula* Dunbar and Skinner, 1937, ut supra.)

Sigmoidella bakomensis Yabe and Asano, **400,** p. 102, pl. 18, fig. 8. Miocene, west Java.

——— *novozealandica* Parr and Collins, **268,** p. 208, pl. 15, fig. 8. Recent, New Zealand, off Puysegur Point, 100 fathoms.

——— *subtaiwanensis* Nakamura, **251,** p. 138, pl. 11, fig. 6. Pliocene, Formosa.

——— *taiwanensis* Nakamura, **251,** p. 138, pl. 11, fig. 7. Pliocene, Formosa.

Sigmoilina edwardsi (Schlumberger, 1887) var. *acuta* Chapman and Parr., **58,** p. 132, pl. 9, fig. 33. Recent, Antarctic, 1180 fathoms.

——— *formosana* Nakamura, **251,** p. 136, pl. 10, fig. 10. Pliocene, Formosa.

——— *orinocoensis* Hedberg, **176,** p. 669, pl. 90, fig. 13. Upper Eocene, Venezuela.

Sigmomorphina batesfordensis Parr and Collins, **268,** p. 204, pl. 15, fig. 6. Lower Miocene, Victoria, Australia.

——— *cubensis* Cushman and Bermúdez, **85,** p. 12, pl. 1, fig. 41. Eocene, Cuba.

——— *haeusleri* Parr and Collins, **268,** p. 203, pl. 15, fig. 1. Upper Eocene, New Zealand.

——— *subulata* Chapman and Parr, **58,** p. 77, pl. 7, fig. 10. Recent, Antarctic, 125 fathoms. [For: *Polymorphina inflata* Pearcey, 1914 (non *P. inflata* Zittel, 1876, non *Sigmomorphina pearceyi* Cushman and Ozawa, 1930), Trans. Roy. Soc. Edinburgh, vol. 49, p. 1023, pl. 2, figs. 14–16.]

——— *wynyardensis* Parr and Collins, **268,** p. 203, pl. 15, fig. 3. Lower Miocene, Tasmania.

Sinzowella sp., Silvestri, **303,** p. 77, pl. 12, fig. 7. Oligocene, Somalia.

Siphogenerina ameliana Fahrion, **128,** p. 200, text figs. 6, 7. Upper Cretaceous, Pemba Bay, Portuguese East Africa.

——— *transversa* Cushman, 1918, var. *cubensis* Cushman and Bermúdez, **85,** p. 16, pl. 2, figs. 8, 9. Eocene, Cuba.

Siphonina advena Cushman, 1922, var. *cubensis* Cushman and Bermúdez, **85,** p. 24, pl. 2, figs. 19, 20. Eocene, Cuba.

Siphonodosaria puntensis Coryell and Embich, **73,** p. 305, pl. 42, fig. 27. Upper Eocene, Panama.

Sphaeroidinella sp., Rao and Rao, **285,** p. 394, pl. 33, figs. 1, 2. Probably Paleocene, southern India.

Spirillina helenae Chapman and Parr, **58,** p. 54, pl. 7, fig. 1. Recent, Antarctic, 2610 fathoms.

——— *spinulosa* Chapman and Parr, **58,** p. 56, pl. 7, fig. 2. Recent, Antarctic, 120 fathoms.

Spiroclypeus blanckenhorni Henson, **180,** p. 50, pl. 4, fig. 7; pl. 5, figs. 1–3. Lower Miocene, Turkish, Syria.

——— ——— ——— var. *ornata* Henson, **180,** p. 51, pl. 5, figs. 4–7; text figs. 3, 4. Lower Miocene, Turkish Syria.

——— *vermicularis* Tan Sin Hok, **346,** p. 187, pl. 1, figs. 7, 8; pl. 2, figs. 6–10; pl. 3, figs. 13–23; pl. 4, figs. 11–18. Eocene, Koetai, east Borneo.

Spiroloculina sp. Silvestri, **333,** p. 79, pl. 7, fig. 4. Miocene, Somalia.

Spirophthalmidium arenarium Nakamura, **251,** p. 137, pl. 11, fig. 3. Pliocene, Formosa.

Spiroplectammina lalickeri Albritton and Phleger, **7,** p. 353, text figs. 2, 3. Upper Cretaceous, Texas.

Spiroplectoides cubensis Cushman and Bermúdez, **85,** p. 13, pl. 1, figs. 44, 45. Eocene, Cuba.

Sporohantkenina, subgen. nov., Bermúdez, **32,** p. 151. Subgenus of *Hantkenina* Cushman, 1924; fam. Hantkeninidae. Subgenotype: *Hantkenina brevispina* Cushman, 1924, Proc. U. S. Nat. Mus., vol. 66, art. 30, p. 2, pl. 2, fig. 3. Eocene Caribbean region.

Staffella fountaini Dunbar and Skinner, **116,** p. 597, pl. 46, figs. 16–20. Permian, Texas.

——— *lacunosa* Dunbar and Skinner, **116,** p. 598, pl. 52, figs. 9–13. Permian Texas.

——— sp., Thompson and Foster, **365,** p. 134, pl. 23, fig. 4. Middle Permian, Szechuan, China.

Stichocibicides cubensis Cushman and Bermúdez, 1936, var. *acus* Bermúdez, **31,** p. 150, pl. 19, figs. 4–6. Eocene, Cuba.

Suggrunda, gen. nov., Hoffmeister and Berry, **182,** p. 29. Fam. Buliminidae; subfam. Heterohelicinae? Genotype: *S. porosa* Hoffmeister and Berry, 1937. Miocene.

——— *porosa* Hoffmeister and C. Berry, **182,** p. 29, pl. 5, figs. 9–11. Miocene, Venezuela.

Svenia, gen. nov., Brotzen, **47,** p. 66. Fam. Nodosariidae. Genotype: *Nodosaria laevigata* Nilsson, 1825, K. Vet. Akad. Handl., p. 342, no fig.; and Nilsson, 1827, Petrif. Suecana, p. 8, pl. 9, figs. 20-a, A, B.

Technitella hystrix Chapman and Parr, **58,** p. 163, pl. 10, fig. 46. Recent, Antarctic, 950 fathoms.

Tetrataxis cumulosa Lee, **215,** p. 69, pl. 1, fig. 5. Carboniferous, Donetz Basin, Russia.

——— *pagodaformis* Lee, **215,** p. 68, pl. 1, fig. 6. Carboniferous, Donetz Basin, Russia.

Textularia bantamensis Yabe and Asano, **400,** p. 113, pl. 17, fig. 16. Pliocene, Bantam, west Java.

——— *exidula* Lee, **215,** p. 70, pl. 1, figs. 8, 10. Carboniferous, Donetz Basin, Russia.

——— *grenadana* Hedberg, **176,** p. 667, pl. 90, figs. 5, 6. Upper Oligocene, Venezuela.

——— *hockleyensis* Cushman and Applin, 1926, var. *malkinae* Coryell and Embich, **72,** p. 714. *Nomen mutatum* for: *T. hockleyensis* Cushman and Applin var. *panamensis* Coryell and Embich, 1937, ut infra.

——— *hockleyensis* Cushman and Applin, 1926, var. *panamensis* Coryell and Embich, **73,** p. 295, pl. 41, fig. 8. Upper Eocene, Panama. (Note: On account of homonymy with *Textularia panamensis* Cushman, 1918, the authors have changed this variety to *T. hockleyensis* var. *malkinae*, ut supra.)

——— *hoppoensis* Nakamura, **251,** p. 134, pl. 10, fig. 4. Pliocene, Formosa.

——— *intosiana* Nakamura, **251,** p. 134, pl. 10, figs. 5, 6. Pliocene, Formosa.

——— *pseudogramen* Chapman and Parr, **58,** p. 153, not figured. [For: *Textularia gramen* H. B. Brady, 1884 (non d'Orbigny, 1846), Challenger Rept., p. 365, pl. 43, figs. 9, 10; and for: *T. gramen* Cushman, 1924 (non d'Orbigny, 1846) Publ. 342, Carnegie Inst. Washington, p. 15, pl. 1, figs. 7, 8.] Recent, Antarctic.

——— *sintikoensis* Nakamura, **251,** p. 135, pl. 10, fig. 7. Pliocene, Formosa.

——— *taiwanica* Nakamura, **251,** p. 135, pl. 10, fig. 8. Pliocene, Formosa.

Textulariella pacifica Cushman, **82,** p. 67, pl. 7,

figs. 11–13. Recent, Pacific, off the coast of California.
——— (?) *varians* Glaessner, **151**, p. 386, pl. 2, fig. 15. Paleocene, northwestern Caucasus, Russia.
Thurammina sp., Eisenack, **122,** p. 234, pl. 15, fig. 29. Silurian, Baltic provinces.
Triloculina tubiformis Yabe and Asano, **400,** p. 116, pl. 17, fig. 9. Pliocene, Bantam, west Java.
Tritaxilina cubensis Cushman and Bermúdez, **85,** p. 7. Eocene, Cuba. (Note: The figures for this species have already been published: Contr. Cushman Lab. Foram. Research, vol. 12, pl. 10, figs. 25, 26, 1936.)
——— *pinarensis* Bermúdez, **34,** p. 237, pl. 20, figs. 1, 2. Eocene, Cuba.
Triticites cuchilloensis Needham, **253,** p. 36, pl. 5, figs. 6, 8–10. Pennsylvanian New, Mexico.
——— *elliptica* Lee, **215,** p. 91, pl. 2, fig. 21. Carboniferous, Donetz Basin, Russia.
——— *fresnalensis* Needham, **253,** p. 42, pl. 6, figs. 12–17. Upper Pennsylvanian, New Mexico.
——— *gallowayi* Needham, **253,** p. 39, pl. 6, figs. 4–7. Upper Pennsylvanian, New Mexico.
——— *graciosa* Lee, **215,** p. 93, pl. 2, fig. 22. Carboniferous, Donetz Basin, Russia.
——— *jemezensis* Needham, **253,** p. 40, pl. 6, figs. 8–11. Upper Pennsylvanian, New Mexico.
——— *kawanoboriensis* Huzimoto, **185,** p. 118, pl. 7, figs. 1–7. Uralian, Japan. [For *?Fusulina montipara* Möller, 1878, Mém. Acad. imp. St. Petersbourg (7), vol. 25, p. 61, pl. 3, fig. 2; pl. 8, fig. 2.; for: *?Fusulina montipara* Möller in Schellwien, 1908, Palaeontographica, vol. 55, p. 185, pl. 19, figs. 8–10; for: *Schellwienia montipara* (Möller) in Ozawa, 1927, Jour. College Sci., imp. Univ. Tokyo, vol. 45, art. 6, p. 40, pl. 9, fig. 1; and for: *Triticites montipara* (Möller) in Huzimoto, 1936, Sci. Rept. Tokyo Bunrika Daigaku, vol. 1, p. 50, pl. 3, figs. 1–7.]
——— *kellyensis* Needham, **253,** p. 35, pl. 5, figs. 2–5, 7. Upper Pennsylvanian, New Mexico.
——— *pinguis* Dunbar and Skinner, **116,** p. 620, pl. 47, figs. 12–19. Permian, Texas.
——— *powwowensis* Dunbar and Skinner, **116,** p. 617, pl. 48, figs. 1–12. Permian, Texas.
——— *rhodesi* Needham, **253,** p. 43, pl. 7, figs. 1–4. Upper Pennsylvanian, New Mexico.
——— *satoi* Huzimoto, **185,** p. 120, pl. 8, figs. 1–8. Uralian, Japan.
——— sp. A, Needham, **253,** p. 45, pl. 7, figs. 5,6. Lower Permian, New Mexico.
——— *subventricosus* Dunbar and Skinner, **116,** p. 619, pl. 49, figs. 15–23. Permian, Texas.
——— *uddeni* Dunbar and Skinner, **116,** p. 616, pl. 47, figs. 1–11. Permian, Texas.
——— *ventricosus* (Meek, 1858) var. *sacramentoensis* Needham, **253,** p. 33, pl. 4, figs. 5, 6, 10, 11; pl. 5, fig. 1. Upper Pennsylvanian, New Mexico.
——— *victoriensis* Dunbar and Skinner, **116,** p. 622, pl. 53, figs. 1–5. Permian, Texas.
——— *wellsi* Needham, **253,** p. 37, pl. 6, figs. 1–3. Pennsylvanian, New Mexico.
Trochammina mawsoni Chapman and Parr, **58,** p. 158, pl. 10, fig. 44. Recent, Antarctic, 1400 fathoms.
——— *nana* (H. B. Brady, 1881) forma A, Bartenstein and Brand, **26,** p. 190, text fig. 20; pl. 2-b, fig. 40. Liassic alpha, northwest Germany.
——— *planoconvexa* Chapman and Parr, **58,** p. 158, pl. 10, fig. 45. Recent, Antarctic, 325 fathoms.
——— sp., Bartenstein, **25,** p. 337, text fig. 7. Middle Devonian, Eifel area, Germany.
——— *taylorana* Cushman, **79,** p. 101, pl. 15, fig. 4. Upper Cretaceous, Texas.
Tubinella jenningsi Coryell and Embich, **73,** p. 293, pl. 41, fig. 14. Upper Eocene, Panama.
Tubulogenerina sp.?, Cushman, **83,** p. 217, pl. 24, fig. 21. Miocene, France.

Uvigerina biserialis Cushman and Edwards, **88,** p. 59, pl. 8, figs. 11, 12. Eocene, France.
——— *boqueronensis* Coryell and Embich, **73,** p. 304, pl. 42, fig. 24. Upper Eocene, Panama.
——— *camagueyana* Bermúdez, **31,** p. 144, pl. 17, fig. 10. Eocene, Cuba.
——— *carapitana* Hedberg, **176,** p. 677, pl. 91, fig. 20. Upper Oligocene, Venezuela.
——— *hantkeni* Cushman and Edwards, **88,** p. 60, pl. 8, figs. 15, 16. Eocene, Hungary. [For: *Uvigerina pygmaea* Hantken, 1876 (non d'Orbigny, 1826), Magy. kir. földt. int. evkönyve, vol. 14, 1875 (1876), p. 52, pl. 7. fig. 4.]
——— *lappa* Cushman and Edwards, **88,** p. 58, pl. 8, fig. 10. Eocene, Austria.
——— *longa* Cushman and Bermúdez, **86,** p. 109, pl. 16, figs. 5, 6. Eocene, Cuba.
——— ——— ——— ——— var. *denticosta* Cushman and Bermúdez, **86,** p. 109, pl. 16, figs. 2, 3. Eocene, Cuba.
——— *pygmaea* d'Orbigny, 1826, var. *capayana* Hedberg, **176,** p. 677, pl. 91, fig. 19. Upper Oligocene, Venezuela.
——— *semivestita* Bermúdez, **31,** p. 143, pl. 17, figs. 8, 9. Upper Eocene, Cuba.
——— *spinulosa* Coryell and Embich, **73,** p. 304, pl. 42, fig. 23. Upper Eocene, Panama. (Note: Preoccupied by *Uvigerina canariensis* d'Orbigny, 1839, var. *spinulosa* Hadley, 1934, Bull. Am. Paleont., vol. 70-a, p. 122, pl. 2, fig. 17.)

Vaginulina clarkeni Coryell and Embich, **73,** p. 296, pl. 41, fig. 20. Upper Eocene, Panama.
——— *hechti* Bartenstein, in Bartenstein and Brand, **26,** p. 165, pl. 8, fig. 31. Dogger alpha, northwest Germany.
——— *selmaensis* Cushman, **79,** p. 101, pl. 15, figs. 8, 9. Upper Cretaceous, Tennessee. [For: *Vaginulina* sp?, Cushman, 1931, Tennessee Geol. Survey, Bull. 41, p. 34, pl. 4, figs. 9, 10.]
——— *subgracilis* Cushman, **79,** p. 103, pl. 15, fig. 13. Upper Cretaceous, Texas. [For: *Vaginulina gracilis* Cushman, 1931 (non Plummer, 1926), Tennessee Geol. Survey, Bull. 41, p. 34, pl. 4, fig. 11.]
——— *suturalis* Cushman, **79,** p. 102, pl. 15, figs. 5–7. Upper Cretaceous, Arkansas. [For: *Vaginulina strigillata* Cushman, 1931 (non

Reuss, 1846), Contr. Cushman Lab. Foram. Research, vol. 6, p. 26, pl. 4, figs. 1, 9, 10.]

Vaginulinopsis compressa Thalmann, **357,** p. 350, pl. 22, fig. 4. Miocene, Florida. [For: *Marginulina dubia* Cushman and Cahill, 1933 (non Neugeboren, 1851), U. S. Geol. Survey, Prof. Paper 175-A, p. 13, pl. 4, fig. 7.]

——— *echinata* Thalmann, **357,** p. 351, pl. 23, fig. 4. Lower Eocene, Texas. [For: *Cristellaria subaculeata* Cushman, 1923, var. *tuberculata* Plummer, 1926, Univ. Texas Bull. 2644, p. 101, pl. 7, fig. 2; pl. 14, fig. 1.]

——— *excreta* Thalmann (**357,** p. 350, pl. 22, fig. 2. Upper Senonian, Germany. [For: *Marginulina bacillum* Reuss, 1860 (non Reuss, 1846), Sitzungsber. k. Akad. Wiss. Wien, vol. 40, p. 208, pl. 6, fig. 8.]

——— *gradata* Thalmann, **357,** p. 351, pl. 23, fig. 5. Miocene, Java. [For: *Cristellaria recta* Scheffen, 1932 (non d'Orbigny, 1840), Wetensch. Mededeel. Dienst Mijnbouw Batavia, vol. 19, p. 197, pl. 1, figs. 4, 5.]

——— *longestriata* Thalmann, **357,** p. 351, pl. 23, fig. 1. Jurassic, Ukraine. [For: unnamed species in Tutkowski, 1925, Mém. Acad. Sci. Ukraine, Cl. sci. phys. math., vol. 1, fasc. 8, pl. 12, figs. 133–136.]

——— *panda* Thalmann, **357,** p. 350, pl. 22, fig. 5. Jurassic, Ukraine. [For: unnamed species in Tutkowski, 1925, Mém. Acad. Sci. Ukraine, Cl. sci. phys. math., vol. 1, fasc. 8, pl. 13, figs. 137–140.]

——— *modesta* Thalmann, **357,** p. 351, pl. 23, fig. 2. Miocene, Calabria, Italy. [For: *Cristellaria articulata* Seguenza, 1880 (non Terquem, 1862, nec *Robulina articulata* Reuss, 1863), Atti R. Accad. Lincei, ser. 3, vol. 6, p. 140, pl. 13, figs. 10, 10-a.]

Valvulammina affinis Cushman and Bermúdez, **85,** p. 8, pl. 5, fig. 3. Eocene, Cuba.

——— *cubensis* Cushman and Bermúdez, **85,** p. 7, pl. 5, fig. 2. Eocene, Cuba.

Valvulina martii Cushman and Bermúdez, **85,** p. pl. 5, fig. 1. Eocene, Cuba.

——— *palmerae* Bermúdez, **31,** p. 139, pl. 16, figs. 1–3. Eocene, Cuba.

——— sp.?, Cushman, **82,** p. 5, pl. 1, fig. 6. Gault, England. [For: *Valvulina conica* Chapman, 1892 (non Parker and Jones, 1865), Jour. Roy. Microsc. Soc. London, p. 5, pl. 11, fig. 11.]

——— sp.?, Cushman, **82,** p. 4, pl. 1, figs. 2–4. Jurassic, Switzerland. [For: *Valvulina conica* Haeusler, 1890 (non Parker and Jones, 1865), Abh. Schweiz. Palaeont. Gesell., vol. 17, p. 76, pl. 12, figs. 30–33.]

Valvulineria cushmani Coryell and Embich, **73,** p. 300, pl. 43, fig. 3. Upper Eocene, Panama.

——— *plummerae* Loetterle, **223,** p. 41, pl. 6, figs. 5, 6. Upper Cretaceous, Nebraska. [For: *Gyroidina nitida* Plummer, 1931 (non Reuss, 1844), Univ. Texas Bull. 3101, p. 191, pl. 14, fig. 5.]

——— *venezuelana* Hedberg, **176,** p. 678, pl. 91, fig. 21. Upper Eocene, Venezuela.

Valvulininae, subfam. nov., Cushman, **82,** p. 1. Fam. Valvulinidae. Tertiary to Recent. Includes the genera: *Cribrobulimina, Valvulina, Clavulina,* and *Valvulammina.*

Ventilabrella sp., Voorwijk, **384,** p. 195, pl. 1, fig. 20. Upper Cretaceous, Cuba.

Verbeekina grabaui Thompson and Foster, **365,** p. 136, pl. 23, figs. 14–16. Middle Permian, Szechuan, China.

——— *heimi* Thompson and Foster, **365,** p. 137, pl. 23, figs. 1–3; pl. 24, fig. 5; pl. 25, figs. 5, 6. Middle Permian, Szechuan, China. [For: *?Schwagerina verbeeki* in Colani, 1924, Mém. Serv. géol. Indochine, vol. 11, fasc. 1, p. 108, and 147, pl. 15, fig. 14; pl. 18, figs. 2, 5, 16–21; pl. 19, figs. 1–9, 11, 13.]

Verneuilina favus Bartenstein, in Bartenstein and Brand, **26,** p. 183, text fig. 18. Dogger epsilon, northwest Germany. (Note: In the explanation to text fig. 18 this species is named: *Verneuilina pulchra-constructa,* n. sp.)

——— *pinarensis* Cushman and Bermúdez, **85,** p. 1, pl. 1, figs. 3, 4. Eocene, Cuba.

——— *pulchra-constructa* Bartenstein, **26,** p. 183, see *V. favus,* ut supra.

——— *villarensis* Cushman and Bermúdez, **85,** p. 1, pl. 1, figs. 1, 2. Eocene, Cuba.

Virgulina davisi Chapman and Parr, **58,** p. 88, pl. 8, fig. 15. Recent, Antarctic, 930 fathoms.

Virgulinella lunata Yabe and Asano, **400,** p. 121, pl. 17, fig. 12. Pliocene, Bantam, west Java.

?Wedekindellina simplicata Lee, **215,** p. 78, pl. 2, fig. 5. Carboniferous, Donetz Basin, Russia.

Wedekindellina ultimata Newell and Keroher, **264,** p. 700, pl. 93, figs. 1–9. Middle Pennsylvanian, Kansas and Missouri.

Xenotheca, gen. nov., Eisenack, **122,** p. 239. Genotype: *X. klinostoma* Eisenack, 1937. Systematic position uncertain: *Foraminifera problematica.* Silurian.

——— *klinostoma* Eisenack, **122,** p. 239, text figs. 21–22. Silurian, Baltic provinces. (Note: *Foraminifer problematicum*).

Zellia, subgen. nov., F. and G. Kahler, **192,** p. 20. Subgenus of *Pseudoschwagerina* Dunbar and Skinner, 1936; fam. Fusulinidae. Subgenotype: *Pseudoschwagerina* (*Zellia*) *heritschi* F. and G. Kahler, 1937, ut supra. Lower Permian, Carnic Alps. (Note: For species and varieties see *Pseudoschwagerina.*)

NOMINA NUDA

The following nomina nuda were recorded from the literature of Foraminifera for the year 1937:

Fusulina kachirica Bolkhovitinowa, and *Fusulinella mosquensis* Bolkhovitinowa, according to Lee, 1937, Bull. Soc. Geol. China, vol. 16, p. 59, both species from the Moscovian of Moscow, Russia.

Globigerina tarchanensis in Krems, **208,** cited from the middle Miocene of the Kuban-Black Sea region.

Pseudoschwagerina moelleri Dutkevitch, and variety *darvasica* Dutkevitch, according to Problems of Soviet Geology, vol. 7, p. 603, both forms from the Permian of Central Asia.

In Kacharava, **430-a,** one new species and one new variety of the genus *Nummulites* was described from Paleogene beds in the Tiflis region of Georgia (Caucasus). This paper has not been available.

BIBLIOGRAPHY AND INDEX FOR THE YEAR 1938

THIS BIBLIOGRAPHY comprises 316 titles of publications devoted exclusively or partly to Foraminifera. For the year 1938 a total of 313 titles are recorded. For the years 1931, 1936, and 1937 respectively, one title is added.

From the literature of the year 1938 there are listed in the following Index one new subfamily, 16 genera, two subgenera, 365 species, 76 varieties, 65 forms to which the *nomenclatura aperta* has been applied, 17 homonyms and 17 *nomina nuda*.

From the 441 new species and varieties 55% were recorded from Tertiary beds, 23% from Mesozoic beds, 13% from Holocene beds, and 9% from Paleozoic beds. No new forms are reported from Cambrian, Silurian, Devonian, and Triassic beds.

The writer would welcome any collaboration regarding new literature, species and other new units of Foraminifera of Russia, in order to issue as completely as possible the annual bibliographies and indexes. The publications of Russian micro-paleontologists are practically inaccessible in the Dutch East Indies, and the writer's correspondence with these authors has been disrupted since the war started. With the cooperation of all who are interested in the annual bibliographies and indexes it might still be possible to issue them regularly in the JOURNAL OF PALEONTOLOGY.

Mrs. Helen Jeanne Plummer, Mrs. Heidi Thalmann, and Dr. Norman D. Newell gave valuable assistance in preparing for print and editorial reading of this Bibliography and Index.

Homonyms.—In accordance with Articles 34, 35, and 36 of the International Rules of Zoological Nomenclature, the following forms, erected in 1938, are homonyms, and, consequently, should be renamed by their respective authors within due time. Full reference to the valid name is given in the following Index.

Bolivina imbricata Cushman, 1925, var. *inflata* Kleinpell, preoccupied by Heron-Allen and Earland, 1913.

——— *subadvena* Cushman, 1926, var. *serrata Natland*, preoccupied by Chapman, 1892, and by Wright, 1900.

Cassidulina tumida Natland, preoccupied by Heron-Allen and Earland, 1922.

Endothyranella gracilis Rauser-Cernoussova, preoccupied by Waters, 1928.

Lepidocyclina (*Nephrolepidina*) *marginata* (Michelotti, 1841) var. *inermis* Flandrin, preoccupied by H. Douvillé, 1911.

Marginulina siliqua Cushman, preoccupied by Seguenza, 1880.

——— *texasensis* Cushman, preoccupied by Cushman and Applin, 1926.

Nummulites irregularis Deshayes, 1838, var. *douvillei* Flandrin, preoccupied by Vredenburg, 1906, and by Prever, 1902.

——— *subirregulariformis* Flandrin, 1938, var. *douvillei* Flandrin, preoccupied by Prever, 1902, by Vredenburg, 1906, and by Flandrin, 1938.

Palmula simplex Cushman, preoccupied by Reuss, 1851. Cushman has since changed the name to *P. primitiva*, 1939.

Quinqueloculina elongata Natland, preoccupied by Karrer, 1877.

Robulus depressus Asano, preoccupied by Michelotti, 1841.

Rotalia depressa Natland, preoccupied by v. Münster, 1838, by Ehrenberg, 1841, and by Clodius, 1930.

Schwagerina ellipsoidalis Rauser-Cernoussova, preoccupied by Schwager, 1883.

Trochammina squamata Jones and Parker, 1860, var. *intermedia* Rhumbler, preoccupied by Rzehak, 1887.

Uvigerinella californica Cushman, 1926, var. *parva* Kleinpell, preoccupied by Cushman and Jarvis, 1929.

Vaginulina tibaensis Asano, 1938, var. *striata* Asano, preoccupied by d'Orbigny, 1826, and by Costa, 1856.

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6. ANONYMOUS, Study of Foraminifera is aid to engineers: *Petroleum Engineer*, Dallas Texas, vol. 10, No. 2, p. 68.
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9. ASANO KIYOSI, Japanese fossil Nodosariidae, with notes on the Frondicularriidae: *Tohoku Imp. Univ. Sendai, Sci. Repts.*, 2nd series, (Geol.), vol. 19, No. 2, pp. 179–200, 4 text figs., pls. 24–31.
10. ASANO, KIYOSI, On the Japanese species of *Elphidium* and its allied genera: *Geol. Soc. Japan, Jour.*, vol. 45, pp. 581–591, pl. 14.
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13. ASANO, KIYOSI, On the Japanese species of *Uvigerina* and its allied genera: *Geol. Soc. Japan, Jour.*, vol. 45, pp. 609–618, pl. 17.
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Adhaerentia, gen. nov., Plummer, **242,** p. 242. Fam. Placopsilinidae. Genotype: *A. midwayensis* Plummer, 1938. Eocene, Alabama. (Note:

see Art. 36, recommendations, first paragraph, regarding *Adherentina* Spandel, 1909, and *Adhaerentina* Paalzow, 1935.)

——— *midwayensis* Plummer, **242,** p. 242, text figs. 1 a–e. Eocene. Mississippi, Alabama, Texas.

Aguayoina, gen. nov., Bermúdez, **33,** p. 386. Fam. Saccamminidae; subfam. Webbinellinae. Genotype: *A. asterostomata* Bermúdez, 1938. Recent, Caribbean Sea.

——— *asterostomata* Bermúdez, **33,** p. 386, pl. 29, figs. 1, 2. Recent, off the south coast of Cuba, depth 150 fathoms.

Alveolina periloculinoides Silvestri, **269,** p. 54, pl. 12, figs. 5, 6, 8. Eocene, Somaliland.

Ammobaculites arenaria Natland, **218,** p. 139, pl. 3, figs. 7, 8. Recent west coast of North America, depth 597 m. (Not *Ammobaculites arenata* Cushman, 1933.)

——— *coprolithiformis* (Schwager, 1866) var. *sequana* Mohler, **213,** p. 11, pl. 2, fig. 1; pl. 3, figs. 1–7; text fig. 8. Lower and middle Sequanian, Swiss Jura Mountains.

——— *nummus* Garrett, **117,** p. 334, pl. 40, figs, 1, 2. Oligocene, Texas.

——— *strathearnensis* Cushman and Le Roy, **85,** p. 122, pl. 22, figs. 1, 2. Lower Miocene, California.

Angulogerina germanica Cushman and Edwards, **82,** p. 85, pl. 15, figs. 14–16. Lower Oligocene, Germany.

——— *japonica* Asano, **13,** p. 615, pl. 17, fig. 17. Recent, Japan Sea, depth 190 m.

——— *subangularis* Parr, **234,** p. 80, pl. 2, fig. 6. Upper Eocene, Western Australia.

Anomalina perthensis Parr, **234,** p. 85, pl. 3, fig. 3. Upper Eocene, Western Australia.

——— *pliocenica* Natland, **218,** p. 150, pl. 6, fig. 5. Pliocene, California.

——— *salinasensis* Kleinpell, **165,** p. 347, pl. 13, fig. 1. Upper Relizian, Burdigalian, California. [For: *Anomalina rotula* Chapman, 1900 (non d'Orbigny, 1846), Calif. Acad. Sci., Proc., Geol., vol. 1, p. 254, pl. 30, fig. 10.]

——— *semicomplanata* Cushman, **77,** p. 68, pl. 12, fig. 1. Upper Cretaceous, Tennessee. [For: *A. complanata Cushman,* 1931 (non Reuss, 1851), Tennessee Div. Geol., Bull. 41, p. 60, pl. 11, fig. 7; and for: *A. complanata* Sandidge, 1932 (non Reuss, 1851), Am. Midland Naturalist, vol. 13, p. 368, pl. 31, figs. 30, 31.]

——— *westraliensis* Parr, **234,** p. 85, pl. 3, fig. 4. Eocene, Western Australia.

Assilina daviesi de Cizancourt, **60,** p. 23, pl. 3, figs. 18, 25, 26; text fig. 2-b. Ypresian, Afghanistan. [For: *A.* cf. *pustulosa* Doncieux in Davies, 1937, Pal. Indica, n.s., vol. 24, p. 34, pl. 4, figs. 13–15, 18, 22.

——— *subumbilicata* de Cizancourt, **60,** p. 24, pl. 3, figs. 21–23. Ypresian, Afghanistan.

——— *umbilicata* de Cizancourt, **60,** p. 23, pl. 3, figs. 19, 20, 27; text figs. 2-c. Ypresian, Afghanistan.

Astacolus etigoensis Asano, **9,** p. 207, pl. 29, fig. 23. Pliocene, Japan.

Asterigerina alabamensis Cushman and McGlamery, **86,** p. 111, pl. 28, fig. 5. Oligocene, Alabama.

——— *choctawensis* Cushman and McGlamery, **86,** p. 111, pl. 28, fig. 2. Oligocene, Alabama.

Baggina cancriformis Kleinpell, **165,** p. 324, pl. 9, fig. 24. Lower Relizian, Burdigalian, California.

——— *robusta* Kleinpell, **165,** p. 325, pl. 11, fig. 8. Relizian, Burdigalian, California. [For: *Discorbina allomorphinoides* Bagg, 1905 (non Reuss, 1860, *Valvulina*), U. S. Geol. Survey, Bull. 268, p. 45, pl. 8, fig. 5. (Note: this species was first mentioned as a *nomen nudum* in Reed and Hollister, 1936, *Am. Assoc. Petroleum Geologists, Bull.*, vol. 20, pp. 1580 and 1607.)

——— ——— var. *globosa* Kleinpell, **165,** p. 326, pl. 13, fig. 2. Lower Luisian, Helvetian, California.

——— *subinaequalis* Kleinpell, **165,** p. 326, pl. 19, figs. 6, 9, 12. Lower Mohnian, Tortonian, California.

Bifarina japonica Asano, **12,** p. 606, pl. 16, fig. 12. Recent, Japan.

Biplanispira absurda Umbgrove, **292,** p. 85, text figs. 1–17. Eocene, southeast Borneo: [For: *Pellatispira crassicolumnata* Umbgrove, 1928, Wetensch. Mededeel. no. 10, Dienst Mijnbouw Nederl.-Indië, p. 24, fig. 79 (? figs. 76 and 80; non figs. 75, 77, 78).]

Bolivina bradyi Asano, **12,** p. 603, pl. 16, figs. 2, 14. Recent, west coast Kii peninsula, Japan. [For: *B. beyrichi* Brady, 1884 (non Reuss, 1851), Challenger Rept., p. 422, pl. 53, fig. 1.]

——— *bramlettei* Kleinpell, **165,** p. 276, pl. 21, figs. 9–11. Upper Mohnian, Tortonian, California.

——— *choctawensis* Cushman and McGlamery, **86,** p. 108, pl. 26, fig. 4. Oligocene, Alabama. (Note: this species has already been published by the authors in Cushman Lab. Foram. Res., Spec. Publ. 9, p. 72, pl. 8, fig. 24, 1937.)

——— *cuneiformis* Kleinpell, **165,** p. 270, pl. 9, fig. 3. Relizian, Burdigalian, California.

——— *dunlapi* Kleinpell, **165,** p. 271, pl. 15, fig. 2. Upper Luisian, Helvetian, California.

——— *eggeri* Cushman, **75,** p. 28. [*Nomen novum* for *B. substriata* Egger, 1893 (non Reuss, 1870), Abh. k. bayer. Akad. Wiss., Classe 2, vol. 18, p. 298, pl. 8, figs. 4–6; and for the same species mentioned in Cushman, 1937, Spec. Publ. 9, Cushman Lab. Foram. Res., p. 138, pl. 18, fig. 3.]

——— *imbricata* Cushman, 1925, var. *inflata* Kleinpell, **165,** p. 274, pl. 14, fig. 3. Luisian, Helvetian, California. Preoccupied by: Heron-Allen and Earland, 1913, Proc. Roy. Irish Acad., vol. 31, part 64, p. 68, pl. 4, figs. 16–19, for a recent Irish form.

——— *marginata* Cushman, 1918, var. *gracillima* Cushman, **75,** p. 29. [*Nomen novum* for: *B. marginata* Cushman, 1918, var. *gracilis* Cushman and Kleinpell, 1934 (non *B. gracilis* Cushman and Applin, 1926), Contr. Cushman. Lab. Foram. Res., vol. 10, p. 10, pl. 2, fig. 3; and for the same species cited in Cushman, 1937, Spec. Publ. 9, Cushman Lab. Foram. Res., p. 88, pl. 10, fig. 15.]

——— *minuta* Natland, **218,** p. 146, pl. 5, fig. 10. Recent, off coast of California, depth 597 m.

——— *perca* Garrett, **117,** p. 315, pl. 40, figs. 8–10. Oligocene, Texas.
——— *perrini* Kleinpell, **165,** p. 278, pl. 7, fig. 4. Upper Saucesian, Aquitanian, California.
——— *pseudodifformis* Asano, **12,** p. 603, pl. 16, fig. 4. Pliocene, Japan.
——— *pseudospissa* Kleinpell, **165,** p. 279, pl. 21, fig. 6. Upper Mohnian, Tortonian, California.
——— *quadricosta* Cushman and McGlamery, **86,** p. 108, pl. 25, fig. 20. Oligocene, Alabama. (Note: this species has already been published by the authors in Spec. Publ. 9, Cushman Lab. Foram. Res., p. 71, pl. 8, fig. 23, 1937.)
——— *rankini* Kleinpell, **165** p. 280, pl. 22, figs. 4, 9. Lower Delmontian, Sarmatian, California.
——— *salinasensis* Kleinpell, **165,** p. 280, pl. 9, fig. 6; pl. 15, fig. 3. Relizian, Burdigalian, California.
——— *subadvena* Cushman, 1926, var. *serrata* Natland, **218.** p. 145, pl. 5, fig. 8, 9. Recent, off Long Beach, California, 107 m. Preoccupied by *B. serrata* (Chapman, 1892, *Textularia*), Jour. Geol. Soc. London, vol. 48, p. 515, pl. 15, fig. 7, from the Taplow Chalk of England; and by *B. obsoleta* (Eley, 1859) var. *serrata* Wright, 1900, in Reade, Geol. Mag., n.s., dec. 4, vol. 7, p. 100, pl. 5, fig. 9.
——— *subhughesi* Kleinpell, **165,** p. 283, pl. 21, figs. 7, 12. Upper Mohnian, Tortonian, California.
——— *ticensis* Kleinpell, **165,** p. 284, pl. 18, figs. 6, 7. Lower Mohnian, Tortonian, California.
——— *tumida* Cushman, 1925, var. *cuneata* Kleinpell, **165,** p. 285, pl. 14, fig. 9. Upper Luisian, Helvetian. California.
——— *vaughani* Natland, **218,** p. 146, pl. 5, fig. 11. Recent, west coast North America, 472 m.
——— *woodringi* Kleinpell, **165,** p. 285, pl. 21, figs. 4, 5. Upper Mohnian, Tortonian, California.
——— *yneziana* Kleinpell, **165,** p. 286, pl. 2, fig. 8. Lower Zemorrian, Rupelian, California.
Bolivinita quadrilatera (Schwager, 1866) var. *cuneata* Asano, **12,** p. 608, pl. 16, fig. 19. Plio-Pleistocene, Japan.
Bolivinopsis crespinae Parr, **234,** p. 81, pl. 3, fig. 11. Upper Eocene, Western Australia.
Bulimina fossa Cushman and F. L. Parker, **87,** p. 56, pl. 9, fig. 10. Pliocene, California.
——— *galliheri* Kleinpell, **165,** p. 253, pl. 17, figs. 2, 5. Upper Luisian, Helvetian, California.
——— *kickapooensis* Cole, **64,** p. 45, pl. 3, fig. 5. Upper Cretaceous, Florida. [For: *B. quadrata* Cushman and F. L. Parker, 1935 (non Plummer, 1927), Contr. Cushman Lab. Foram. Res., vol. 11, p. 100, pl. 15, figs. 13, 14, 16 (non figs. 12, 15).]
——— *madrugaensis* Bermúdez, **30,** p. 89, text figs. 1–3. Upper Cretaceous, Cuba.
——— *marginospinata* Cushman and F. L. Parker, **77,** p. 57, pl. 9, fig. 11. Pliocene, California.
——— *montereyana* Kleinpell, **165,** p. 254, pl. 12, fig. 13. Luisian, Helvetian, California. [For: *B. ovata* Hanna, 1928 (non d'Orbigny, 1846), Bull. Am. Assoc. Petroleum Geologists, vol. 12, pl. 9, fig. 1; and for: *B. pseudotorta* Barbat and Johnson, 1934 (non Cushman, 1926), Jour. Paleont., vol. 8, p. 13, pl. 1, fig. 10.]
——— ——— ——— var.. *delmonteensis* Kleinpell, **165,** p. 255, pl. 16, fig. 9. Lower Delmontian, Sarmatian, California.
——— *ovula* d'Orbigny, 1839, var. *pedroana* Kleinpell, **165,** p. 255, pl. 22, fig. 13. Lower Delmontian, Sarmatian, California.
——— *pagoda* Cushman, 1927, var. *deformata* Cushman and F. L. Parker, **87,** p. 58, pl. 10, fig. 3. Pliocene, California.
——— ——— ——— var. *denudata* Cushman and F. L. Parker, **87,** p. 57, pl. 10, figs. 1, 2. Pliocene, Italy.
——— *pseudoaffinis* Kleinpell, **165,** p. 257, pl. 9, fig. 9. Upper Saucesian, Aquitanian, California.
Buliminella choctawensis Cushman and McGlamery, **86,** p. 107, pl. 25, figs. 11, 16. Oligocene, Alabama.
——— *multicamerata* Cushman and F. L. Parker, **87,** p. 60, pl. 10, figs. 11, 12. Pliocene, Italy.
——— *semihispida* Kleinpell, **165,** p. 250, pl. 20, figs. 8, 15, 16. Upper Mohnian, Tortonian, California.
——— *westraliensis* Parr, **234,** p. 80, pl. 2, figs. 3, 4. Upper Eocene, Western Australia.

Calcitornella textulariiformis Fagginger-Auer, **105,** p. 28, pl. 4, fig. 70. Jurassic, Dogger, Germany.
Cancris panamensis Natland, **218,** p. 148, pl. 6, fig. 1. Recent, Pacific, off Panama. Depth 82 m.
——— *sagra* (d'Orbigny, 1839) var. *pauciloculata* Cushman and McGlamery, **86,** p. 110, pl. 27, fig. 6. Oligocene, Alabama. [For: *Pulvinulina sagra* Cushman, 1933 (non d'Orbigny, 1839), U. S. Geol. Survey, Prof. Paper 133, p. 45, pl. 6, figs. 9, 10.]
Cassidulina panzana Kleinpell, **165,** p. 335, pl. 8, fig. 9. Upper Saucesian, Aquitanian, California. [For: *C. crassa* Cushman, 1926 (non d'Orbigny, 1839), Contr. Cushman Lab. Foram. Res., vol. 2, p. 56, pl. 7. fig. 4.]
——— *spiralis* Natland, **218,** p. 149, pl. 6, fig. 4. Lower Pleistocene, California.
——— *tumida* Natland, **218,** p. 148, pl. 6, figs. 2, 3. Recent, Pacific, off Panama, depth 597 m. Preoccupied by *C. laevigata* d'Orbigny, 1826, var. *tumida* Heron-Allen and Earland, 1922, Brit. Antarctic Exped., Zool., vol. 6, p. 137, pl. 5, figs. 8–10.
——— *williami* Kleinpell, **165,** p. 337, pl. 14, fig. 5; pl. 17, figs. 7, 8. Lower Luisian, Helvetian, California.
Causia, gen. nov., Rhumbler, **254,** p. 171. Fam. Archimonothalamidia Rhumbler. Genotype: *C. injudicata* Rhumbler, 1938. Recent.
——— *injudicata* Rhumbler, **254,** p. 172, text figs. 7–10. Recent, beach sand, Heligoland.
——— *sidebottomi* Rhumbler, **254,** p. 174, text fig. 6. Recent, Palermo Harbour, and west coast of San Salvador. [For: Foraminifera?, in Sidebottom, 1910, Proc. Manchester Litt. Phil. Soc., vol. 54, no. 16, p. 30, pl. 3, fig. 18.]
Ceratobulimina westraliensis Parr, **234,** p. 83, pl. 2, fig. 12. Upper Eocene, Western Australia.
Chrysalogonium eximium Cushman, **76,** p. 42, pl. 7, figs. 5–8. Upper Cretaceous, Texas.

Cibicides altamiraensis Kleinpell, **165,** p. 351, pl. 19, figs. 4, 5, 8. Lower Mohnian, Tortonian, California.

——— *berryi* Cushman, **77,** p. 71, pl. 12, fig. 6. Upper Cretaceous, Alabama. For: *Truncatulina coonensis* W. Berry, 1929, Proc. U. S. Nat. Mus., vol. 76, art. 19, p. 12, pl. 3, figs. 1–3. (Note: according to the International Rules of Zoological Nomenclature it is not permissible to change the specific name when the generic name is changed, except in case of homonymy. This form should read correctly: *Cibicides coonensis* (W. Berry, 1929).)

——— *choctawensis* Cushman and McGlamery, **86,** p. 111, pl. 28, fig. 6. Oligocene, Alabama.

——— *cookei* Cushman and Garrett, **83,** p. 65, pl. 11, fig. 3. Lower Oligocene, Alabama.

——— *pippeni* Cushman and Garrett, **83,** p. 64, pl. 11, fig. 2. Lower Oligocene, Alabama.

——— *pseudoconvexus* Parr, **234,** p. 86, pl. 3, fig. 5. Upper Eocene, Western Australia.

——— *relizensis* Kleinpell, **165,** p. 355, pl. 7, fig. 15. Upper Saucesian, Aquitanian, California.

——— *spiralis* Natland, **218,** p. 151, pl. 7, fig. 7. Lower Pliocene, California.

——— *stephensoni* Cushman, **77,** p. 70, pl. 12, fig. 5. Upper Cretaceous, Alabama.

——— *tuberculata* Natland, **218,** p. 152, pl. 7, fig. 8. Recent, west coast North America, depth 434 m.

——— *umbonifer* Parr, **234,** p. 86, pl. 3, fig. 6. Upper Eocene, Western Australia.

Citharina arambourgi Marie, **205,** p. 98, pl. 8, figs. 12, 13. Upper Albian, Paris Basin, France.

——— cf. *discors* (Koch, 1848) var. *gracilis* Marie, **205,** p. 97, pl. 8, fig. 9. Middle Albian, Paris Basin, France.

——— *d'orbignyi* Marie, **205,** p. 95, pl. 8, fig. 8. Middle Albian, Paris, Basin, France.

——— *laffittei* Marie, **205,** p. 95, pl. 8, fig. 7. Lower Albian, Paris Basin, France.

——— *lemoinei* Marie, **205,** p. 98, pl. 8, fig. 11. Upper Albian (top beds), Paris Basin, France.

Citharinella, gen. nov., *Marie,* **205,** p. 99. Fam. Lagenidae. Genotype: *Flabellina karreri* Berthelin, 1880, Mém. Soc. géol. France (3), vol. 1, no. 5, p. 62, pl. 4, figs. 1–3, from the Albian of Montcley, France. Range: Vraconnian and Upper Senonian, Europe and North America.

——— *chapmani* Marie, **205,** p. 100, pl. 7, figs. 5, 6; pl. 8, fig. 1. Upper Albian (top beds), Paris Basin, France.

——— *laffittei* Marie, **205,** p. 101, pl. 8, fig. 13. Vraconnian, Paris Basin, France.

——— *lemoinei* Marie, **205,** p. 101, pl. 8, fig. 2. Vraconnian, Paris Basin, France. [For: *Frondicularia lanceola* Chapman, 1894 (non Reuss, 1860), Jour. Roy. Microsc. Soc., London, p. 157, pl. 3, fig. 15.]

Conicospirillina basiliensis Mohler, **213,** p. 27, pl. 4, figs. 4, 5. Upper Sequanian, Swiss Jura Mountains.

Coskinolina alvus Silvestri, **269,** p. 77, pl. 5, fig. 5. Eocene, Somaliland.

Cuneolina? bermudezi Palmer, **227,** p. 295, pl. 23, figs. 4, 13, 16, 17. Upper Cretaceous, Cuba.

Cuneolina cojimarensis Palmer, **227,** p. 298, pl. 23 (non pl. 22) figs. 8–10, 12, 15. Upper Oligocene, Cuba.

Dentalina angusticostata Cushman, **76,** p. 41, pl. 6, figs. 21, 22. Upper Cretaceous, Texas.

——— *basiplanata* Cushman, **76,** p. 38, pl. 6, figs. 6–8. Upper Cretaceous, Texas. [For: *D. annulata* Cushman, 1931 (non Reuss, 1850), Tennessee Geol. Div., Bull. 41, p. 28, pl. 3, fig. 3.

——— *basitorta* Cushman, **76,** p. 37, pl. 6, figs. 4, 5. Upper Cretaceous, Mississippi.

——— *delicatula* Cushman, **76,** p. 40, pl. 6, figs. 19, 20. Upper Cretaceous, Texas.

——— *involvens* Cushman, **76,** p. 37, pl. 6, fig. 3. Upper Cretaceous, Texas.

——— *nakumarai* Asano, **9,** p. 214, pl. 27, figs. 54, 55. Pliocene, Japan.

——— *pertinens* Cushman, **76,** p. 40, pl. 6, figs. 15, 18. Upper Cretaceous, Texas.

——— *pioneerensis* Kleinpell, **165,** p. 213, pl. 4, fig. 7. Lower Zemorrian, Rupelian, California.

——— *setanaensis* Asano, **9,** p. 215, pl. 30, figs. 9–12, 30–32. Pliocene, Japan.

——— *siribesiensis* Asano, **9,** p. 215, pl. 30, figs. 15, 16. Pliocene, Japan.

——— *solvata* Cushman, **76,** p. 39, pl. 6, figs. 9–14. Upper Cretaceous, Mississippi.

Dictyoconus africanus Silvestri, **269,** p. 58, pl. 5, fig. 3; pl. 6, fig. 5; pl. 10, fig. 2. Eocene, Somaliland.

——— *cayeuxi* Lucas, **194,** p. 353, text figs. 1–6. Jurassic, Aalenian, western Oran.

Discorbinella valmontensis Kleinpell, **165,** p. 350, pl. 21, figs. 14–16. Upper Mohnian. Tortonian, California.

Discorbis choctawensis Cushman and McGlamery, **86,** p. 109, pl. 26, figs. 15, 16. Oligocene Alabama.

——— *cocoaensis* Cushman and Garrett, **85,** p. 63, pl. 11, fig. 1. Upper Eocene, Alabama. [For: *D. subauracana* Cushman, 1935 (non Cushman, 1922), U. S. Geol. Survey, Prof. Paper 181, p. 43, pl. 18, fig. 1.]

——— *cycloclypeus* Hochwin and Parr, **148,** p. 302, pl. 16, fig. 11; pl. 18, figs. 5, 12; pl. 19, fig. 13. Upper Pliocene, Adelaide, Australia.

——— *globularis* (d'Orbigny, 1826) forma *cyprinodon* Rhumbler, **254,** p. 207, text fig. 59. Recent, moderate and subtropical shallow seas.

Earlmyersia, gen. nov., Rhumbler, **254,** p. 209. Fam. Rotaliaridae Rhumbler; subfam. Discorbinae Cushman. Genotype: *Pulvinulina punctulata* Heron-Allen and Earland, 1913 (non d'Orbigny, 1826, *Rotalia*), Proc. Roy. Irish Acad. (5), vol. 31, pt. 64, p. 134, pl. 4, figs. 20, 21. Recent.

——— *punctulata* (d'Orbigny, 1826) forma *liliputana* Rhumbler, **254,** p. 210, text fig. 60. Recent, beach sands, Heligoland. (Note: Rhumbler gives the same synomymal reference for this form as for the genotype of the genus, and states d'Orbigny as the original author instead of Heron-Allen and Earland.)

Ellipsonodosaria alexanderi Cushman, 1936, var. *impensia* Cushman, **76,** p. 48, pl. 8, figs. 4, 5. Upper Cretaceous, Texas.

——— *minuta* Cushman— **76,** p. 48, pl. 8, fig. 6 Upper Cretaceous, Texas.
——— *stephensoni* Cushman, 1936, var. *speciosa* Cushman, **76,** p. 47, pl. 8, fig. 3. Upper Cretaceous, Arkansas.
Elphidiella nagaoi Asano, **10,** p. 590, pl. 14, fig. 8. Pliocene, Hokkaido.
Elphidium adelaidense Howchin and Parr, **148,** p. 300, pl. 18, fig. 7; pl. 19, figs. 5, 6. Upper Pliocene, Adelaide, Australia.
——— *granti* Kleinpell, **165,** p. 238, pl. 19, figs. 1, 11. Lower Mohnian, Tortonian, California. [For: *Polystomella crispa* Bagg, 1905 (non Linné, 1758), U. S. Geol. Survey, Bull. 268, p. 54, pl. 11, fig. 4.]
——— *kusiroense* Asano, **10,** p. 590, pl. 14, fig. 2. Pleistocene, Hokkaido, Japan.
——— *rotatum* Howchin and Parr, **148,** p. 309, pl. 18, fig. 8. Miocene, Adelaide, Australia.
——— *subgranulosum* Asano, **10,** p. 586, pl. 14, fig. 4. Pliocene to Recent, Japan. [For: *Polystomella striato-punctata* Brady, 1884 (non Fichtel and Moll, 1798), Challenger Rept., p. 733, pl. 109, fig. 22; for: *Themeon granulosa* Galloway and Wissler, 1927, Jour. Paleont., vol. 1, p. 83, pl. 12, figs. 15, 16; for: *Elphidium hughesi* Cushman and Grant, 1927, Trans. San Diego Soc. Nat. Hist., vol. 5, no. 6, p. 75, pl. 7, fig. 1; and for: *Elphidium decipiens* Hada, 1931 (non Costa, 1856), Sci. Rep. Tohoku imper. Univ. Sendai, series 4, vol. 6, no. 1, p. 126, text fig. 83.]
——— *translucens* Natland, **218,** p. 144, pl. 5, figs. 3, 4. Recent, Avalon Bay, California. 9, 7 m.
——— *tumidum* Natland, **218,** p. 144, pl. 5,. figs. 5, 6. Recent, Avalon Bay, California 9, 7 m.
——— *yabei* Asano, **10,** p. 589, pl. 14, figs. 9, 10. Pliocene, Hokkaido, Japan.
Endothyranella gracilis Rauser-Cernoussova, **247,** p. 95, pl. 1, fig. 4. Middle Carboniferous, Samara and Trans-Volga Region, U.R.S.S. Preoccupied by *E. gracilis* (Waters, 1928, *Ammobaculites*); teste: Galloway and Harlton, 1930, Jour. Paleont., vol. 4, p. 27.[1]
——— *protracta* Rauser-Cernoussova, **247,** p. 96, pl. 1, fig. 5. Upper Carboniferous, Samara and Trans-Volga regions, Russia.
Eorupertia neocomiensis Pfender, **238,** p. 236, pl. 16, figs. 1–7. Lower Cretaceous, Valanginian, France.
Eponides alabamensis Cushman and McGlamery, **86,** p. 110, pl. 27, fig. 2. Oligocene, Alabama.
——— *choctawensis* Cushman and McGlamery, **86,** p. 110, pl. 27, fig. 1. Oligocene, Alabama.
——— *frizzelli* Kleinpell, **165,** p. 318, pl. 2, figs. 12, 15, 16. Lower Zemorrian, Rupelian, California. [For: *Eponides* sp., Frizzell and Blackwelder, 1933, Micropal. Bull., vol. 4, Stanford Univ., no. 2, p. 55, pl. (p. 63), figs. I, J, K.]
——— *multicameratus* Kleinpell, **165,** p. 320, pl. 19, figs. 2, 3, 7. Lower Mohnian, Tortonian, California.
——— *sasai* Asano, **14,** p. 94, pl. 10, figs. 2, 3. Pliocene, Hokkaido.

Fissurina circulo-costa Asano, **9,** p. 219, pl. 30, fig. 17. Pliocene, Japan.
Flourensina, gen. nov., Marie, **205,** p. 91. Fam. Valvulinidae or Verneuilinidae. Genotype: *F. douvillèi* Marie, 1938. Upper Vraconnian, Middle Cretaceous.
——— *cayeuxi* Marie, **205,** p. 93, pl. 7, fig. 4. Upper Vraconnian, Paris Basin, France.
——— *douvillèi* Marie, **205,** p. 92, pl. 7, fig. 1. Upper Vraconnian, Paris Basin, France.
——— *jacobi* Marie, **205,** p. 93, pl. 7, fig. 3. Upper Vraconnian, Paris Basin, France.
——— *lemoinei* Marie, **205,** p. 92, pl. 7, fig. 2. Upper Vraconnian, Paris Basin, France.
Fusulinella böcki (von Moeller, 1877) var. *zidoensis* Huzimoto, **151,** p. 274, pl. 8, figs. 12, 13. Uralian, Japan.

Gaudryina accelerata Natland, **218,** p. 139, pl. 3, figs. 9, 10. Recent, west coast of North America, 165 m.
——— *quadrata* Natland, **218,** p. 139, pl. 3, figs. 14–16. Recent, off southern California, 102 m.
——— *subtenuis* Cushman, **75,** p. 28. *Nomen novum* for: *G. tenuis* Cushman, 1936 (non Grzybowski, 1897), Spec. Publ. 6, Cushman Lab. Foram. Res., p. 10, pl. 2, fig. 5; and for the same reference in Cushman, 1937, Spec. Publ. 7, Cushman Lab. Foram. Res., p. 70, pl. 10, figs. 2, 3.
Geminaricta pacifica Asano, **12,** p. 608, pl. 16, fig. 22. Recent, Toyama Bay, Sea of Japan.
Globigerina hexagona Natland, **218,** p. 149, pl. 7, fig. 1. Recent, west coast of North America, depth 884 m.
——— *quinqueloba* Natland, **218,** p. 149, pl. 6, fig. 7. Recent, west coast of North America, 152 m.
Globigerinoides minuta Natland, **218,** p. 150, pl. 7, figs. 2, 3. Recent, west coast North America, 122 m.
Globorotalia chapmani Parr, **234,** p. 87, pl. 3, figs. 8, 9. Upper Eocene, Western Australia.
Globotruncana cretacea Cushman, **77,** p. 67, pl. 11, fig. 6. Upper Cretaceous, Tennessee. [For: *G. arca* Cushman 1931 (non Cushman, 1926), Tennessee Div. Geol., Bull. 41, p. 59, pl. 11, fig. 6; for: *G. arca* Cushman, 1936 (non Cushman, 1926) Bull. Geol. Soc. America, vol. 47, p. 419, pl. 1, fig. 14; for: *G. arca* Plummer, 1931 (non Cushman, 1926), Univ. Texas Bull. 3101, p. 195, pl. 13, figs. 7–9, 11; and for: *G. arca* Loetterle, 1937 (non Cushman, 1926), Nebraska Geol. Survey, ser. 2, Bull. 12, p. 47, pl. 7, fig. 8.]
Globulina fimbriata Cushman and McGlamery, **86,** p. 105, pl. 24, fig. 20. Oligocene, Alabama.
Glomospira ammodiscoidea Rauser-Cernoussova, **247,** p. 151, pl. 1, figs. 1–3. Middle Carboniferous, Samara and Trans-Volga regions, Russia.
Goësella pliocenica Natland, **218,** p. 140, pl. 3, fig. 13. Lower Pliocene, California.

[1] The holotype and numerous topotypes show this rough test to be composed definitely of quartz grains bound inconspicuously by an insoluble cement. The species must therefore be known as *Ammobaculites gracilis* Waters.

Gümbelina carinata Cushman, **74,** p. 18, pl. 3, fig. 10. Upper Cretaceous, Texas.
——— *costulata* Cushman, **74,** p. 16, pl. 3, figs. 7–9. Upper Cretaceous, Texas.
——— *glabrans* Cushman, **74,** p. 15, pl. 3, figs. 1, 2. Upper Cretaceous, Texas. [For: *G. tessera* Cushman, 1936 (non Ehrenberg, 1854, *Grammostomum*), Bull. Geol. Soc. America, vol. 47, p. 418, pl. 1, fig. 9.]
——— *globocarinata* Cushman, **74,** p. 10, pl. 2, figs. 4, 5. Upper Cretaceous, Texas.
——— *moremani* Cushman, **74,** p. 10, pl. 2, figs. 1–3. Middle Cretaceous, Texas. [For: *G. globulosa* Moreman, 1927 (non Ehrenberg, 1838), Jour. Paleont., vol. 1, p. 99, pl. 16, fig. 10; for: *G. globifera* Carman, 1929 (non Reuss, 1860), Jour. Paleont., vol. 3, p. 311, pl. 34, fig. 3; and for: *G. globifera* Morrow, 1934 (non Reuss, 1860), Jour. Paleont., vol. 8, p. 194, pl. 29, figs. 15, 17.]
——— *planata* Cushman, **74,** p. 12, pl. 2, figs. 13, 14. Upper Cretaceous, Texas.
——— *pseudotessera* Cushman, **74,** p. 14, pl. 2, figs. 19–21. Upper Cretaceous, Texas. [For: *G. tessera* Cushman, 1932 (non Ehrenberg, 1854, *Grammostomum*), Jour. Paleont., vol. 6, p. 338, pl. 51, figs. 4, 5; and for the same name in Loetterle, 1937, Nebraska Geol. Survey, ser. 2, Bull. 12, p. 34, pl. 5, fig. 4.
——— *punctulata* Cushman, **74,** p. 13, pl. 2, figs. 15, 16. Upper Cretaceous, Texas.
——— *reussi* Cushman, **74,** p. 11, pl. 2, figs. 6–9. Upper Cretaceous, Texas. [For: *Textularia globulosa* Reuss, 1846 (non Ehrenberg, 1838), Verstein. böhm. Kreide, 1845–46, pt. 1, p. 39, pl. 12, fig. 23(?).]
——— *semicostata* Cushman, **74,** p. 16, pl. 3, fig. 6. Upper Cretaceous, Texas.
——— *venezuelana* (Nuttall, 1935) var. *rugosa* Parr, **234,** p. 82, pl. 2, fig. 8. Upper Eocene, Western Australia.
Gyroidina arkadelphiana Cushman, **76,** p. 49, pl. 8, fig. 7. Cretaceous, Arkansas.
——— *relizana* Kleinpell, **165,** p. 315, pl. 10, fig. 11. Upper Relizian, Burdigalian, California.
——— *scalata* Garrett, **117,** p. 316, pl. 40, figs. 12, 13. Miocene, Louisiana.

Haplophragmella irregularis Rauser-Cernoussova, **247,** p. 94, pl. 1, figs. 6–7. Viséan, Trans-Volga and Samara regions, Russia.
Haplophragmoides evoluta Natland, **218,** p. 138, pl. 3, figs. 5, 6. Recent, west coast of North America, depth 872 m.
——— *lenticularis* Natland, **218,** p. 138, pl. 3, figs. 3, 4. Recent, west coast of North America, 597 m.
Heronallenia pusilla Parr, **234,** p. 82, pl. 2, fig. 11. Upper Eocene, Western Australia.
Hopkinsina nodosa Natland, **218,** p. 147, pl. 5, figs. 13, 14. Lower Pliocene, Los Angeles, California.

Ichthyolaria (*Frondicularia*) *aequistriata* Fagginger-Auer, **105,** p. 21, pl. 3, fig. 5. Lower Liassic, Germany.
——— *tetracostata* Fagginger-Auer, **105,** p. 21, pl. 3, fig. 14. Lower Liassic, Germany.

Jadammina, gen. nov., Bartenstein and Brand, **24,** p. 381. Fam. Trochamminidae. Genotype: *J. polystoma* Bartenstein and Brand, 1938. Recent (alluvium), northern Germany.
——— *polystoma* Bartenstein and Brand, **24,** p. 381, text figs. 1–3. Recent, Jade Bay, North Sea, Germany.

Karreriella baccata (Schwager, 1866) var. *japonica* Asano, **14,** p. 90, pl. 10, fig. 1. Pliocene, Hokkaido, Japan.
——— *milleri* Natland, **218,** p. 140, pl. 3, figs. 11, 12. Lower Pliocene, California.

Lagena luciae Parr, **234,** p. 78, pl. 1, fig. 13. Upper Eocene, Western Australia.
——— *perthensis* Parr, **234,** p. 78, pl. 1, fig. 14. Upper Eocene, Western Australia.
——— *terrilli* Parr, **234,** p. 79, pl. 1, fig. 15. Upper Eocene, Western Australia.
Lenticulina relizensis Kleinpell, **165,** p. 205, pl. 10, fig. 6. Upper Relizian, Burdigalian, California. [For: *Cristellaria gibba* Bagg, 1905 (non d'Orbigny, 1839), U. S. Geol. Survey, Bull. 268, p. 37, pl. 5, fig. 6.]
Lepidocyclina (*Nephrolepidina*) *marginata* (Michelotti, 1841) var. *inermis* Flandrin, **111,** p. 100, pl. 9, figs. 19, 20. Oligocene, Algeria. Preoccupied by *Lepidocyclina* (*Eulepidina*) *inermis* H. Douvillé, 1911, Philippine Jour. Sci., vol. 6, p. 72, pl. D, fig.]
Linderina nuttali Silvestri, **269,** p. 79, pl. 3, fig. 5; pl. 6, fig. 6. Eocene, Somaliland.
Lingulina huenei Kuhn, **172,** p. 6, text fig. 14. Jurassic, Callovian, Germany.
——— *taylorana* Cushman, **76,** p. 43, pl. 7, fig. 9. Upper Cretaceous, Texas.
Lockhartia alveolata Silvestri, **269,** p. 58, pl. 11, fig. 4. Eocene, Somaliland.
Loftusia occidentalis Milovanovic, **211,** pp. 121–134, pls. 1, 2. Upper Cretaceous, Maestrichtian, central Serbia (Yugoslavia).
Loxostoma amygdalaeforme (Brady, 1881) var. *iokiense* Asano, **12,** p. 605, pl. 16, fig. 3. Pliocene, Japan.
——— *minutissimum* Cushman, **76,** p. 45, pl. 7, fig. 19. Upper Cretaceous, Texas.

Marginulina ascensionensis Howe and McDonald, **146,** p. 209, pl. 1, figs. 1–4. Upper Oligocene, Louisiana.
——— *curvatura* Cushman, **76,** p. 34, pl. 5, figs. 13, 14. Upper Cretaceous, Texas.
——— *inconstantia* Cushman, **76,** p. 33, pl. 5, figs. 4–9. Upper Cretaceous, Texas.
——— *jarvisi* Cushman, **76,** p. 35, pl. 5, figs. 17, 18. Upper Cretaceous, Trinidad. [For: *Cristellaria grata* Cushman, 1926 (non Reuss, 1863), Bull. Am. Assoc. Petroleum Geologists, vol. 10, p. 598, pl. 19, fig. 1; for: *Lenticulina grata* Cushman and Jarvis, 1928 (non Reuss, 1863, *Cristellaria*), Contr. Cushman Lab. Foram. Res., vol. 4, p. 96, pl. 14, fig. 3; for: *Marginulina grata* Cushman and Jarvis, 1932 (non Reuss, 1863, *Cristellaria*), Proc. U. S. Nat. Mus., vol. 80, art. 14, p. 25, pl. 7, fig. 7; pl. 8, fig. 3; and for: *Marginulina schloenbachi*

Cushman and Jarvis, 1932 (non Reuss, 1863), *ibid.*, p. 26, pl. 8, fig. 5.]

——— *juncea* Cushman, **76,** p. 33, pl. 5, fig. 10. Upper Cretaceous, Texas.

——— *munda* Cushman, **76,** p. 34, pl. 5, figs. 11, 12. Upper Cretaceous, Texas.

——— *nozimaensis* Asano, **9,** p. 210, pl. 28, figs. 29–31; pl. 30, figs. 13, 14. Pliocene, Japan.

——— *siliqua* Cushman, **76,** p. 34, pl. 5, figs. 15, 16. Upper Cretaceous, Texas. Preoccupied by Seguenza, 1880, Atti R. Accad. Lincei, ser. 3, vol. 6, p. 222 (not figured), from the Pliocene of Italy.

——— *sorrentoensis* Howe and McDonald, **146,** p. 210, pl. 1, figs. 5, 6. Upper Oligocene, Louisiana.

——— *texasensis* Cushman, **78,** p. 95. *Nomen novum* for: *M. texana* Cushman, 1937 (non Garrett and Ellis, 1937), Contr. Cushman Lab. Foram. Research, vol. 13, p. 95, pl. 14, figs. 1–4, from the Upper Cretaceous of Texas. Preoccupied again by: *Marginulina fragaria* Gümbel, 1868, var. *texasensis* (Cushman and Applin, 1926), Bull. Am. Assoc. Petroleum Geologists, vol. 10, p. 171, pl. 8, figs. 5–7. according to Cushman, 1935, U. S. Geol. Survey, Prof. Paper, vol. 181, p. 19, pl. 7, figs. 8–10. (Teste also: Ellisor, 1933, Bull. Am. Assoc. Petrol. Geol., vol. 17, p. 1336, pl. 2, fig. 4.)

——— *uedai* Asano, **9,** p. 210, pl. 27, figs. 7, 8. Pliocene, Japan.

Massilininae, subfam. nov., Lacroix, **175,** p. 1. Fam. Miliolidae. Comprises the genera: *Massilina* Schlumberger, 1893; *Praemassilina* Lacroix, 1938, ut infra; *Pseudomassilina* Lacroix, 1938, ut infra. Recent, tropics and, subtropics.

Miogypsina (*Miogypsina*) *gunteri* Cole, **64,** p. 42, pl. 6, figs. 10–12; pl. 8, figs. 1–9. Upper Oligocene, Florida. [For: *M.* cf. *irregularis* Barker and Grimsdale, 1937 (non Michelotti, 1841), Ann. Mag. Nat. Hist., vol. 19, ser. 10, p. 163, pl. 5, figs. 4, 5; 7–10; pl. 7, figs. 2, 3; and for: *Miogypsina* sp., Hanna and Gravell, 1934, Guidebook 11, Ann. Field Trip, Shreveport Geol. Soc., pl. 6, figs. 3, 4.]

Miogypsinella, subgen. nov., Hanzawa, **128,** Subgenus of genus *Miogypsina* Sacco 1893, p. 389. Subgenotype: *Miogypsina* (*Miogypsinella*) *borodinensis* Hanzawa, 1938, *nomen nudum.* Aquitanian, Japan.

Miliolina akneriana (d'Orbigny, 1846) var. *elongata* Gherke, **119,** pl. 1, figs. 8–13; pl. 2, figs. 1, 2. Middle Miocene, Caucasus, Russia.

——— ——— ——— ——— ——— forma *angustocamerata* Gherke, **119,** p. 305, pl. 1, figs. 12, 13. Middle Miocene, Caucasus, Russia.

——— ——— ——— ——— ——— forma *compressa* Gherke, **119,** p. 302, pl. 2, figs. 1, 2. Middle Miocene, Caucasus, Russia.

——— ——— ——— ——— ——— forma *cucumis* Gherke, **119,** p. 302, pl. 1, figs. 10, 11. Middle Miocene, Caucasus, Russia.

——— ——— ——— ——— ——— forma *media* Gherke, **119,** p. 301, pl. 1, figs. 8, 9. Middle Miocene, Caucasus, Russia.

——— ——— ——— var. *longa* Gherke, **119,** p. 305, pl. 2, figs. 3–8, 11, 12. Middle Miocene, Caucasus, Russia.

——— ——— ——— ——— ——— forma *argunica* Gherke, **119,** p. 305, pl. 2, figs. 11, 12. Middle Miocene, Caucasus, Russia.

——— ——— ——— ——— ——— forma *compressa* Gherke, **119,** p. 306, pl. 2, figs. 3, 4. Middle Miocene, Caucasus, Russia.

——— ——— ——— ——— ——— forma *cucumis* Gherke, **119,** p. 306, pl. 2, figs. 5–8. Middle Miocene, Caucasus, Russia.

——— ——— ——— var. *media.* Gherke, **119,** p. 301, pl. 1, figs. 2–4. Middle Miocene, Caucasus, Russia.

——— ——— ——— var. *rotunda* Gherke, **119,** p. 296, pl. 1, fig. 1. Middle Miocene, Caucasus, Russia.

Miscellanea assilinoides Silvestri, **269,** p. 72, pl. 3, fig. 4. Eocene, Somaliland.

Nautiloculina, gen. nov., Mohler, **213,** p. 18. Fam. Ophthalmidiidae (not stated by the author). Genotype: *N. oolithica* Mohler, 1938. Jurassic (Middle Rauracian to upper Sequanian). Swiss Jura Mountains.

——— *oolithica* Mohler, **213,** p. 19, pl. 4, figs. 1–3, 6; text fig. 6. Rauracian and Middle Sequanian, Swiss Jura Mountains.

Nipponitella, gen. nov., Hanzawa, **127,** p. 256. Fam. Fusulinidae. Genotype: *N. explicata* Hanzawa, 1938. Permian, northeastern Japan.

——— *auricula* Hanzawa, **127,** p. 207; text figs. 1, 2. Permian, Japan.

——— *expansa* Hanzawa, **127,** p. 257, text figs. 4–7, Permian, Japan.

——— *explicata* Hanzawa, **127,** p. 256, text figs. 8–10. Permian, Japan.

Nodobaculariella cultrata Howchin and Parr, **148,** p. 296, pl. 15, fig. 14. Upper Pliocene, Adelaide, Australia.

Nodogenerina cienegaensis Kleinpell, **165,** p. 244, pl. 6, fig. 4. Lower Saucesian, Aquitanian, California.

——— *irregularis* Kleinpell, **165,** p. 245, pl. 17, fig. 12. Upper Mohnian, Tortonian, California.

——— *lohmani* Kleinpell, **165,** p. 245, pl. 4, fig. 6. Lower Zemorrian, Rupelian, California.

——— *sanctaecrucis* Kleinpell, **165,** p. 246, pl. 4, fig. 22. Lower Zemorrian, Rupelian, California.

Nodosarella primitiva Cushman, **76,** p. 46, pl. 8, fig. 2. Upper Cretaceous, Texas.

——— *texana* Cushman, **76,** p. 46, pl. 8, fig. 1. Upper Cretaceous, Texas.

Nodosaria corsicana Cushman, **76,** p. 42, pl. 7, figs. 1–4. Cretaceous, Texas.

——— *estorffi* Kleinpell, **165,** p. 217, pl. 4, fig. 21; pl. 6, fig. 5. Lower Zemorrian, Rupelian, California. [For: *Nodosaria*? sp., Barbat and Estorff, 1933, Jour. Paleont., vol. 7, p. 169, pl. 23, fig. 15.]

——— *gracilitatis* Cushman, **76,** p. 41, pl. 6, figs. 23–26. Upper Cretaceous, Texas.

——— *hamilli* Kleinpell, **165,** p. 218, pl. 4, figs. 4, 5. Lower Zemorrian, Rupelian, California.

——— *subraphana* Asano, **9,** p. 212, pl. 29, fig. 19; pl. 30, fig. 33, 35. Pliocene, Japan.

Nonion goudkoffi Kleinpell, **165,** p. 231, pl. 20,

figs. 2, 5. Upper Mohnian, Tortonian, California.

——— *incisum* (Cushman, 1926) var. *kernensis* Kleinpell, **165,** p. 232, not figured. Upper Zemorrian, Rupelian, California. [Proposed for: *N. incisum* Cushman and F. L. Parker, 1931 (non Cushman, 1926), Contr. Cushman Lab. Foram. Res., vol. 7, p. 7, pl. 1, fig. 26; and for the same species in Cushman and Le Roy, 1938, Jour. Paleont., vol. 12, p. 125, pl. 22, fig. 8, and in Cushman and Laiming, 1931, *ibid.*, vol. 5, p. 104, pl. 11, fig. 9.]

——— *japonicum* Asano, **11,** p. 593, pl. 15, figs. 1, 2. Pliocene, Japan.

——— *japonicum* Asano, **11,** p. 593, pl. 15, figs. 1, 2. Pliocene, Japan.

——— *lunatum* Garrett, **117,** p. 314, pl. 40, figs. 3, 4. Oligocene, Louisiana.

——— *pompilioides* (Fichtel and Moll, 1798) var. *etigoense* Asano, **11,** p. 596, pl. 15, fig. 10. Pliocene, Japan.

——— *schencki* Kleinpell, **165,** p. 235, pl. 16, fig. 11. Lower Delmontian, Sarmatian, California. [For: *Nonion incisa* Hanna, 1928 (non Cushman, 1926), Bull. Am. Assoc. Petrol. Geol., vol. 12, pl. 9, fig. 2.]

——— *ynezianum* Kleinpell, **165,** p. 237, pl. 2, figs. 1, 2. Lower Zemorrian, Rupelian, California.

Nonionella ansata Cushman, **76,** p. 44, pl. 7, fig. 17. Cretaceous, Alabama.

Nummulites afghanica de Cizancourt, **60,** p. 15, pl. 1, figs. 3, 7, 8, 11; pl. 2, figs. 11, 12; text fig. 1. Ypresian, Afghanistan.

——— *betieri* Flandrin, **111,** p. 76, pl. 7, figs. 25, 26. Oligocene or Upper Lutetian, Algeria.

——— *dalloni* Flandrin, **111,** p. 76, pl. 7, figs. 23, 24. Oligocene, Algeria.

——— *dolloti* de Cizancourt, **60,** p. 17, pl. 3, figs. 1–3, 5. Ypresian, Afghanistan.

——— *doncieuxi* Flandrin, **111,** p. 77, pl. 7, figs. 29–34. Priabonian, Algeria.

——— *irregulariformis* Flandrin, **111,** p. 23, pl. 2, figs. 18–27, 30–33. Oligocene, Algeria.

——— *irregularis* Deshayes, 1838, var. *douvillèi* Flandrin, **111,** p. 21, pl. 1, figs. 30–37. Ypresian and Lower Lutetian, Algeria. Preoccupied by *N. douvillèi* Vredenburg, 1906, Rec. Geol. Survey India, vol. 34, p. 79, pl. 8, figs. 1–13, which species is preoccupied by *N.* (*Gümbelia*) *douvillèi* Prever, 1902, Mém. Soc. Pal. Suisse, vol. 29, p. 55, pl. 2, figs. 25, 26.

——— *joleaudi* Flandrin, **111,** p. 75, pl. 7, figs. 27, 28. Priabonian, Algeria.

——— *morissanensis* Flandrin, **111,** p. 37, pl. 3, figs. 1, 2. Priabonian, Algeria.

——— *numidus* Flandrin, **111,** p. 37, pl. 3, figs. 11–20. Priabonian and Oligocene, Algeria. [For: *Nummulites* sp. A, Flandrin, 1934, Bull. Soc. géol. France, (5), vol. 4, p. 258, pl. 14, figs. 8, 9, 11 (non fig. 10).]

——— *subafghanica* de Cizancourt, **60,** p. 16, pl. 1, figs. 4, 9, 10. Ypresian, Afghanistan.

——— *subdolloti* de Cizancourt, **60,** p. 18, pl. 3, figs. 4, 7. Ypresian and Lower Lutetian, Afghanistan.

——— *subirregulariformis* Flandrin, **111,** p. 24, pl. 2, figs. 28, 29. Oligocene, Algeria.

——— ——— ——— var. *douvillèi* Flandrin, **111,** p. 23, pl. 1, fig. 38. Ypresian and Lower Lutetian, Algeria. Preoccupied, see: *N. irregularis* Deshayes, 1838, var. *douvillèi* Flandrin, 1938, ut supra.

——— *subrotularia* de Cizancourt, **60,** p. 19, pl. 3, figs. 15, 16. Ypresian and Lower Lutetian, Afghanistan. *Nomen novum* for: *N. guettardi* H. Douvillé, 1919 (non d'Archiac and Haime, 1853), Mém. Carte géol. France, pl. 1, fig. 3.

——— *suburoniensis* de Cizancourt, **60,** p. 22, pl. 2, figs. 5–10. Lower and Middle Lutetian, Afghanistan. [For: the megalospheric generation of *N. uroniensis* Heim, 1908, Mém. Soc. pal. Suisse, vol. 35, p. 229, pl. 1, figs. 6–10; pl. 2, figs. 4–24.]

Operculina kawakawaensis Chapman and Parr, **53,** p. 288, pl. 16, fig. 9; text fig. 3. Miocene, New Zealand. [For: *O. complanata* Chapman, 1926 (non Defrance, 1822), New Zealand Geol. Survey, Pal. Bull., vol. 11, p. 91, pl. 18, fig. 1; pl. 19, fig. 3.]

——— *matapauensis* Chapman and Parr, **53,** p. 288, p. 17, figs. 10, 11; text fig. 4. Miocene, New Guinea.

———? *umbonifera* Howchin and Parr, **148,** p. 309, pl. 18, figs. 3, 4, 6, 13, 14. Miocene, Adelaide, Australia.

——— *victoriensis* Chapman and Parr, **53,** p. 284, pl. 16, figs. 3–8; text fig. 2. Miocene, Victoria, Australia. [For: *O. complanata* Chapman, 1910 (non Defrance, 1822), Proc. Roy. Soc. Victoria, vol. 22, p. 294; and for: *O. bartschi* Crespin, 1936 (non Cushman, 1921), Dept. Interior Canberra, Pal. Bull., vol. 2, pl. 1, fig. 12.]

Palmula pilulata Cushman, **76,** p. 37, pl. 6, fig. 2. Cretaceous, Texas.

——— *simplex* Cushman, **76,** p. 36, pl. 6, fig. 1. Upper Cretaceous, Texas. Note: Since *Palmula* replaces *Flabellina*, this species must be regarded as being preoccupied by *Flabellina simplex* Reuss, 1851, Haidinger's Naturwiss. Abhandl., vol. 4, p. 31, pl. 2, figs. 1, 2.

Parafrondicularia, gen. nov., Asano, **9,** p. 189. Fam. Lagenidae. Genotype: *P. japonica* Asano, 1938. Pliocene.

——— *japonica* Asano, **9,** p. 189, pl. 25, fig. 26. Pliocene, Japan.

Paraschwagerina stachei F. and G. Kahler, **158,** p. 109, text-plate figs. 6–9. Lower Permian, Carinthia, Austria.

Planoglobulina taylorana Cushman, **74,** p. 23, pl. 4, figs. 9, 10. Upper Cretaceous, Texas.

Planularia bôsô Asano, **9,** p. 206, pl. 26, figs. 1–4, 6. Pliocene, Japan.

——— *dubia* Kleinpell, **165,** p. 207, pl. 13, fig. 4. Lower Luisian, Helvetian, California.

——— *luciana* Kleinpell, **165,** p. 207, pl. 9, fig. 25. Upper Saucesian, Aquitanian, California.

——— *nagaoi* Asano, **9,** p. 206, pl. 30, fig. 1. Pliocene, Japan.

——— *yabei* Asano, **9,** p, 205, pl. 24, fig. 6. Pliocene, Japan.

Planulina alavensis Palmer, **228,** p. 345, text figs. A–C. Oligocene, Cuba.

——— *appressa* Kleinpell, **165,** p. 348, pl. 6, figs. 14, 19, 20. Lower Saucesian, Aquitanian, California.

——— *austinana* Cushman, **77,** p. 68, pl. 12, fig. 2. Upper Cretaceous, Texas.

——— *baggi* Kleinpell, **165,** p. 349, pl. 8, fig. 14. Upper Saucesian, Aquitanian, California. [For: *Anomalina ariminensis* Bagg, 1905 (non d'Orbigny, 1826), U. S. Geol. Survey, Bull. 268, p. 48, pl. 9, fig. 5; for: *Truncatulina wuellerstorfi* Bagg, 1905 (non Schwager, 1866), *ibid.*, p. 47, pl. 9, fig. 3; and for: *Truncatulina lobatula* Bagg, 1905 (non Walker and Jacob, 1798), *ibid.*, p. 46, pl. 9, fig. 1.]

——— *limbata* Natland, **218,** p. 151, pl. 7, figs. 4, 5. Recent, west coast of North America, off Panama, depth 520 m.

——— *nacatochensis* Cushman, **76,** p. 50, pl. 8, fig. 9. Cretaceous, Arkansas.

——— *spissocostata* Cushman, **77,** p. 69, pl. 12, fig. 4. Upper Cretaceous, Texas.

——— *texana* Cushman, **77,** p. 69, pl. 12, fig. 3. Upper Cretaceous, Texas.

Plectofrondicularia barbati Kleinpell, **165,** p. 239, not figured. Lower Zemorrian, Rupelian, California. [For: *Ptectofrondicularia*, n. sp., Barbat and v. Estorff, 1933, Jour. Paleont., vol. 7, p. 170, pl. 23, fig. 5.]

——— *miocenica* Cushman, 1926, var. *laimingi* Kleinpell, **165,** p. 241, not figured. Lower Saucesian, Aquitanian, California. [For: *P. miocenica* Cushman and F. L. Parker, 1931 (non Cushman, 1926), Contr. Cushman Lab. Foram. Res., vol. 7, pl. 1, fig. 28.

Praemassilina, gen. nov., Lacroix, **175,** p. 3. Fam. Miliolidae. Genotype: *Massilina rugosa* Sidebottom, 1904, Proc. Manchester Lit. Phil. Soc., vol. 48, no. 5, p. 18, pl. 5, figs. 5, 6; text fig. 7. Recent.

Profusulinella aljutovica Rauser-Cernoussova, **247,** p. 97, pl. 1, figs. 10–12. Middle Carboniferous, Samara and Trans-Volga regions, Russia.

——— ——— ——— var. *elongata* Rauser-Cernoussova, **247,** p. 99, pl. 1, fig. 13. Middle Carboniferous, Samara and Trans-Volga regions, Russia.

——— *ovata* Rauser-Cernoussova, **247,** p. 101, pl. 1, figs. 14–16. Middle Carboniferous, Samara and Trans-Volga regions, Russia.

——— *priscoidea* Rauser-Cernoussova, **247,** p. 102, pl. 2, figs. 1–3. Middle Carboniferous, Samara and Trans-Volga regions, Russia.

Pseudocyclammina sequana (Merian, 1851) var. *major* Mohler, **213,** p. 16, pl. 1, figs. 3, 4. Middle Sequanian, Swiss Jura Mountains.

——— ——— ——— var. *minor* Mohler, **213,** p. 16, pl. 1, figs. 5, 6; pl. 2, figs. 1–5; text figs. 2, 5. Lower Sequanian, Swiss Jura Mountains.

Pseudofusulina baituganensis Rauser-Cernoussova, **247,** p. 137, pl. 8, fig. 4. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *krotowi* (Schellwien, 1908) var. *nux* Rauser-Cernoussova, **247,** p. 144, pl. 9, figs. 3, 4. Permo-Carboniferous, Samara and Trans-Volga regions, Russia. [For: *Fusulina krotowi* Schellwien, 1908, Palaeontographica, vol. 55, p. 192, pl. 20, figs. 8–10; for: *Schellwienia krotowi* Ozawa, 1925 (non Schellwien, 1908), Jour. College Sci. Imper. Univ. Tokyo, vol. 45, art. 6, p. 27, pl. 7, figs. 5, 6.]

——— ——— ——— var. *sphaeroidea* Rauser-Cernoussova, **247,** p. 146, pl. 9, figs. 5–7. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *parajaponica* Beljaev, **26,** p. 187, pl. 2, figs. 8, 9. Upper Carboniferous, Urals, Russia.

——— *paramölleri* Rauser-Cernoussova, **247,** p. 139, pl. 8, figs. 5–7. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *sokensis* Rauser-Cernoussova, **247,** p. 135, pl. 8, figs. 1, 2. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *stabilis* Rauser-Cernoussova, **247,** p. 133, pl. 7, figs. 8, 9; pl. 8, fig. 3. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— ——— ——— var. *longa* Rauser-Cernoussova, **247,** p. 134, pl. 7, fig. 10. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *uralica* (Krotow, 1888) var. *parva* Beljaev, **26,** p. 184, pl. 2, figs. 1–4. Upper Carboniferous, Urals, Russia. (Note: This form was already published in 1936, but is here again designated as a new variety.)

——— ——— ——— var. *sphaerica* Beljaev, **26,** p. 185, pl. 2, figs. 5–7. Upper Carboniferous, Urals, Russia.

Pseudoglandulina clarkei Parr, **234,** p. 77, pl. 1, fig. 11. Upper Eocene, Western Australia.

Pseudomassilina, gen. nov., Lacroix, **174,** p. 8. Fam. Miliolidae. Genotype: *Massilina australis* Cushman, 1932, U. S. Nat. Mus., Bull. 161, p. 32, pl. 8, fig. 2. Recent.

——— *corrugata* Lacroix, **175,** p. 9, text figs. 6, 7. Recent, Gulf of Akaba, Red Sea.

——— ——— ——— var. *jubata* Lacroix, **175,** p. 10, text figs. 8, 9. Recent, Gulf of Akaba, Red Sea.

——— *macilenta* (Brady, 1884) var. *earlandi* Lacroix, **175,** p. 8, text fig. 5. Recent, Chagos Islands, Indian Ocean.

——— *oblonga* Lacroix, **175,** p. 5, text figs. 2 a-c. Recent, Red Sea.

——— ——— ——— var. *robusta* Lacroix, **175,** p. 5, text figs. 3 a-c. Recent, Bay of Cauda, Indo-China.

Pseudonummulites garunlensis Silvestri, **269,** p. 80, pl. 9, fig. 3. Eocene, Somaliland.

Pseudoschwagerina geyeri F. and G. Kahler, **158,** p. 101, text figs. 1–3. Permian, Carinthia, Austria.

Pseudovaginulina laevis Fagginger-Auer, **105,** p. 27, pl. 4, figs. 57, 62. Dogger, Jurassic, Germany.

——— *minima* Fagginger-Auer, **105,** p. 26, pl. 4, fig. 56. Upper Dogger, Jurassic, Germany.

Pullenia miocenica Kleinpell, **165,** p. 338, pl. 14, fig. 6. Luisian, Helvetian, California.

——— ——— ——— var. *globula* Kleinpell, **165,** p. 340, pl. 16, fig. 2. Luisian, Helvetian, California.

——— *moorei* Kleinpell, **165,** p. 340, pl. 18, figs.

11, 16. Lower Mohnian, Tortonian, California.

——— *pedroana* Kleinpell, **165,** p. 341, pl. 22, figs. 14, 15. Lower Delmontian, Sarmatian, California.

Pulvinulinella glabrata Cushman, **77,** p. 66, pl. 11, fig. 4. Upper Cretaceous, Texas.

——— *gyroidinaformis* Cushman and Goudkoff, **84,** p. 2, pl. 1, figs. 1, 2. Miocene, California.

——— *navarroana* Cushman, **77,** p. 66, pl. 11, fig. 5. Upper Cretaceous, Texas.

——— *obtusa* (Burrows and Holland, 1897) var. *westraliensis* Parr, **234,** p. 84, pl. 3, fig. 1. Upper Eocene, Western Australia. [For: *P. exigua* (Brady, 1884) var. *obtusa* Cushman and Ponton, 1932 (non *Pulvinulina exigua* Brady, 1884, var. *obtusa* Burrows and Holland, 1897), Contr. Cushman Lab. Foram. Res., vol. 8, p. 71, pl. 9, fig. 9.]

——— *relizensis* Kleinpell, **165,** p. 329, pl. 10, fig. 10. Upper Saucesian, Aquitanian, California.

——— *texana* Cushman, **76,** p. 49, pl. 8, fig. 8. Upper Cretaceous, Texas.

Pyrgo ezo Asano, **14,** p. 93, pl. 9, fig. 1. Pliocene, Hokkaido, Japan.

Quinqueloculina adelaidensis Howchin and Parr, **148,** p. 293, pl. 15, figs. 5, 7. Upper Pliocene, Adelaide, Australia.

——— *catalinensis* Natland, **218,** p. 142, pl. 4, fig. 3. Recent, off southern California depth 9, 7 m.

——— *elongata* Natland, **218,** p. 141, pl. 4, fig. 5. Recent, west coast of North America, depth 152 m. Preoccupied by *Q. sarmatica* Karrer, 1877, var. *elongata* Karrer, 1877, Abh. k. k. geol. Reichsanstalt Wien, vol. 9, p. 376, pl. 16-a, fig. 11-b.

——— *gigas* Natland, **218,** p. 141, pl. 4, fig. 4. Recent, west coast of North America, depth 152 m.

——— *granulosa* Natland, **218,** p. 141, pl. 4, fig. 1. Recent, Avalon Bay, California.

——— *hasimotoi* Asano, **14,** p. 92, pl. 10, fig. 5. Pliocene, Hokkaido, Japan.

——— *microcostata* Natland, **218,** p. 142, pl. 4, fig. 6. Recent, Avalon Bay, California.

Ramulina arkadelphiana Cushman, **76,** p. 43, pl. 7, figs. 12–14. Cretaceous, Arkansas.

——— *globo-tubulosa* Cushman, **76,** p. 44, pl. 7, fig. 16. Upper Cretaceous, Texas. [For: *Ramulina* sp.(?) Cushman, 1931, Tennessee Geol. Survey, Bull. 41, p. 42, pl. 7, fig. 1.]

——— *navarroana* Cushman, **76,** p. 43, pl. 7, figs. 10, 11. Cretaceous, Texas.

——— *ornata* Cushman, **76,** p. 44, pl. 7, fig. 15. Upper Cretaceous, Trinidad. [For: *Ramulina* sp.?, Cushman and Jarvis, 1932, Proc. U. S. Mus. Nat. Hist., vol. 80, art. 14, p. 41, pl. 12, fig. 11 (non fig. 10).]

Rectogümbelina hispidula Cushman, **74,** p. 21, pl. 3, figs. 20–22. Cretaceous, Texas.

——— *minuta* Cushman, **76,** p. 45, pl. 7, fig. 18. Upper Cretaceous, Texas.

Remaneica, gen. nov., Rhumbler, **254,** p. 194. Fam. Rotaliaridia (Trochamminidae) Rhumbler. Genotype: *R. helgolandica* Rhumbler, 1938. Recent, North Sea.

——— *helgolandica* Rhumbler, **254,** p. 195, text figs. 38–45. Recent, beach sand, Heligoland, Germany.

——— *plicata* (Terquem, 1875) var. *lichenopsis* Rhumbler, **254,** p. 202, text figs. 50–55. Recent, Heligoland, Germany, and west coast of Scotland.

Reophax depressa Natland, **218,** p. 138, pl. 3, figs. 1, 2. Recent, west coast of North America, depth 221 m.

Robertina germanica Cushman and F. L. Parker, **88,** p. 73, pl. 13, fig. 2 (non pl. 16). Lower Oligocene, Germany.

——— *plummerae* Cushman and F. L. Parker, **88,** p. 73, pl. 13 (non pl. 16), fig. 1. Middle Eocene, Texas.

Robulus calcarioides Asano, **9,** p. 200, pl. 24, fig. 20. Pliocene, Japan.

——— *depressus* Asano, **9,** p. 202, pl. 25, fig. 15; pl. 26, figs. 10, 27; pl. 18, fig. 11. Pliocene, Japan. Preoccupied by *Robulina depressa* Michelotti, 1841, Mem. Soc. Ital. Sci., vol. 22, p. 291, pl. 2, fig. 3.

——— *etigoensis* Asano, **9,** p. 203, pl. 30, fig. 38. Pliocene, Japan.

——— *hughesi* Kleinpell, **165,** p. 198, pl. 7, fig. 18. Lower Relizian, Burdigalian, California. [For: *Cristellaria cassis* Bagg, 1905 (non Fichtel and Moll, 1798), U. S. Geol. Survey, Bull. 268, p. 35, pl. 6, fig. 2.]

——— *interruptus* Asano, **9,** p. 204, pl. 30, figs. 5–7. Pliocene, Japan.

——— *kotiensis* Asano, **9,** p. 203, pl. 29, fig. 35. Pliocene, Japan.

——— *kimituensis* Asano, **9,** p. 203, pl. 26, figs. 15, 17, 23, 24. Pliocene, Japan.

——— *mohnensis* Kleinpell, **165,** p. 200, pl. 18, figs. 1, 2. Lower Mohnian, Tortonian, California.

——— *navarroensis* (Plummer, 1926) var. *extruatus* Cushman, **76,** p. 31, pl. 5, fig. 1. Upper Cretaceous, Texas.

——— *pseudorotulatus* Asano, **9,** p. 201, pl. 25, figs. 1, 3, 4; pl. 26, fig. 28; pl. 31, figs. 3, 6. Pliocene, Japan.

——— *pseudosecans* Cushman, **76,** p. 32, pl. 5, fig. 3. Upper Cretaceous, Tennessee.

——— *reedi* Kleinpell, **165,** p. 201, pl. 7, fig. 23; pl. 8, fig. 5. Saucesian, Aquitanian, California. [For: *Cristellaria* (*Robulina*) *gerlandi* Bagg, 1905 (non Andreae, 1884) U. S. Geol. Survey, Bull. 268, p. 36, pl. 6, fig. 5.]

——— *sagamiensis* Asano, **9,** p. 201, pl. 25, fig. 6; pl. 26, figs. 11–13; pl. 28, fig. 12; pl. 29, fig. 16. Pliocene, Japan.

——— *sasai* Asano, **9,** p. 204, pl. 30, fig. 8. Pliocene, Japan.

——— *spissocostatus* Cushman, **76,** p. 32, pl. 5, fig. 2. Upper Cretaceous, Texas.

——— *smileyi* Kleinpell, **165,** p. 202, pl. 15, fig. 14. Upper Relizian, Burdigalian, California.

——— *tibaensis* Asano, **9,** p. 203, pl. 26, fig. 16; pl. 30, fig. 27. Pliocene, Japan.

——— *tumidus* Asano, **9,** p. 200, pl. 24, fig. 9. Pliocene, Japan.

Rotalia alabamensis Cushman and McGlamery,

86, p. 110, pl. 27, fig. 5. Oligocene, Alabama.
——— *choctawensis* Cushman and McGlamery, **86,** p. 110, pl. 27, fig. 4. Oligocene, Alabama.
——— *depressa* Natland, **218,** p. 147, pl. 5, fig. 15. Recent, California. Preoccupied by: von Münster, 1838, in Römer, N. Jahrb. f. Min. etc., p. 388, pl. 3, fig. 46; by Ehrenberg, 1841, Abh. k. Akad. Wiss. Berlin, p. 428; by Ehrenberg, 1854, Mikrogeologie, pl. 25, i, A, fig. 48; and by *Rotalia girardana* Reuss, 1851, var. *depressa* Clodius, 1930, Mitt. Mecklenburg. Geol. Landesanstalt, vol. 39, Neue Folge, vol. 4, p. 114.
——— *garveyensis* Natland, **218,** p. 147, pl. 6, fig. 6. Upper Miocene and Lower Pliocene, California.
——— *verriculata* Howchin and Parr, **148,** p. 310, pl. 19, figs. 8, 9, 11, 15. Miocene, Adelaide, Australia. [For: *Rotalia calcar* Chapman, 1910 (non d'Orbigny, 1826), Proc. Roy. Soc. Victoria, vol. 22, p. 289, pl. 53, fig. 2.]

Saccularia reticulata Wedekind in Fagginger-Auer, **105,** p. 26, pl. 4, figs. 53–55. Upper Liassic to Lower Dogger, Germany.
——— *striata* Wedekind in Fagginger-Auer, **105,** p. 25, pl. 4, figs. 50–52, and p. 30, pl. 5, figs. 92, 93. Middle Dogger and Lower Malm (Jurassic), Germany.
Saracenaria angularis Natland, **218,** p. 143, pl. 5, figs. 1, 2. Recent, California.
Schubertella pauciseptata Rauser-Cernoussova, **247,** p. 96, pl. 1, figs. 8, 9. Middle Carboniferous, Samara and Trans-Volga regions, Russia.
Schwagerina ellipsoidalis Rauser-Cernoussova, **247,** p. 130, pl. 7, figs. 5–9. Permo-Carboniferous, Samara and Trans-Volga regions, Russia. Preoccupied by *Schwagerina lepida* (Schwager, 1883) var. *ellipsoidalis* Schwager, 1883, in: Richthofen, China, vol. 4, p. 118; and in Steinmann, 1888, Elemente d. Paläont. vol. 1, p. 32, text fig. 15-g.
——— *pavlovi* Rauser-Cernoussova, **247,** p. 127, pl. 6, figs. 6, 7. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.
Seabrookia cretacica Bermúdez, **32,** p. 164, text figs. 1–3. Upper Cretaceous, Cuba.
Sigmoilina tschokrakensis Gherke, **119,** p. 308, pl. 3, figs. 1–18. Middle Miocene, Caucasus, Russia.
——— ——— ——— forma *angusta* Gherke, **119,** p. 311, pl. 3, fig. 1. Middle Miocene, Caucasus, Russia.
——— ——— ——— forma *circularis* Gherke, **119,** p. 315, pl. 3, fig. 7. Middle Miocene, Caucasus, Russia.
——— ——— ——— forma *compressa* Gherke, **119,** p. 312, pl. 3, figs. 4, 13, 18. Middle Miocene, Caucasus, Russia.
——— ——— ——— forma *inflata* Gherke, **119,** p. 315, pl. 3, figs. 8–10. Middle Miocene, Caucasus, Russia.
——— ——— ——— forma *media* Gherke, **119,** p. 311, pl. 3, figs. 2, 3, 11. Middle Miocene, Caucasus, Russia.
——— ——— ——— forma *plana* Gherke, **119,** p. 315, pl. 2, fig. 9; pl. 3, figs. 5, 6, 14–17. Middle Miocene, Caucasus, Russia.
Sigmomorphina hokkaidoensis Asano, **14,** p. 97, pl. 11, fig. 10. Pliocene, Hokkaido, Japan.
——— *kuromatunaiensis* Asano, **14,** p. 98, text figs. 2, 3. Pliocene, Hokkaido, Japan.
——— *nagaoi* Asano, **14,** p. 97, pl. 11, fig. 1. Pliocene, Hokkaido, Japan.
——— *setanaensis* Asano, **14,** p. 98, text fig. 1. Pliocene, Hokkaido, Japan.
——— *subregularis* Howchin and Parr, **148,** p. 308, pl. 18, fig. 2, 11. Miocene, Adelaide, Australia.
Siphogenerina nuciformis Kleinpell, **165,** p. 303, pl. 15, figs. 10, 12. Upper Luisian, Helvetian, California.
——— *smithi* Kleinpell, **165,** p. 304, pl. 6, figs. 1, 2. Upper Zemorrian, Rupelian, California.
Somalina, gen. nov., Silvestri, **269,** p. 59. Family not stated. Genotype: *S. stefaninii* Silvestri, 1938. Eocene.
——— *stefaninii* Silvestri, **269,** p. 59, pl. 7, figs. 6, 7. Eocene, Somaliland.
Spirillinoides, gen. nov., Rhumbler, **254,** p. 174. Fam. Ammodisculinidae Rhumbler. Genotype: *S. circumcinctus* Rhumbler, 1938. Recent.
——— *circumcinctus* Rhumbler, **254,** p. 175, text figs. 11–15. Recent, beach sand, Heligoland, Germany.
Spiroloculina lapidigera Howchin and Parr, **148,** p. 294, pl. 15, fig. 10. Upper Pliocene, Adelaide, Australia. [For: *Spiroloculina* sp. cf. *S. arenaria* Brady, in Parr, 1932, Proc. Roy. Soc. Victoria, vol. 44, n. s., p. 220, pl. 22, fig. 41.]
Spiroplectammina coreyi Cushman and Le Roy, **85,** p. 123, pl. 22, fig. 5. Lower Miocene, California.
——— *kewi* Cushman and Le Roy, **85,** p. 122, pl. 22, fig. 4. Lower Miocene, California. Staffella *chaputi* Ciry, **58,** p. 56, pl. 1, fig. 2. Permian, Turkey.
——— *compressa* Rauser-Cernoussova, **247,** p. 103, pl. 2, figs. 8–10. Middle Carboniferous, Samara and Trans-Volga regions, Russia.
——— *haymanaensis* Ciry, **58,** p. 54, pl. 1, fig. 1. Permian, Turkey.
Suggrunda californica Kleinpell, **165,** p. 287, pl. 18, figs. 8–10. Lower Mohnian, Tortonian, California.
Sulcoperculina, subgen. nov., Thalmann, **280,** p. 330. Subgenus of *Operculina* d'Orbigny, 1826. Fam. Nummulitidae. Subgenotype: *?Camerina dickersoni* Palmer, 1934, Mem. Soc. cubana hist. nat., vol. 8, p. 243, pl. 14, figs. 1, 2, 4, 6, 8; text figs. 4, 5. Upper Cretaceous.

Textularia cubensis Lalicker and Bermúdez, **178,** p. 171, pl. 28, fig. 3. Upper Eocene Cuba. (Cave: *T. mexicana* Cushman, 1922, var. *cubana* Palmer and Bermúdez, 1936.)
——— *magnifica* Lalicker and Bermúdez, **178,** p. 171, pl. 28, fig. 4. Upper Eocene, Cuba.
——— *marielensis* Lalicker and Bermúdez, **178,** p. 170, pl. 28, figs. 1, 2. Upper Eocene, Cuba.
——— *obusa* Huzimoto, **151,** p. 272, pl. 8, fig. 3. Uralian, Japan.
——— *paalzowiana* Kuhn, **172,** p. 4, text fig. 4. Jurassic, Callovian, Germany.
——— *shivelyi* Kleinpell, **165,** p. 190, pl. 1, figs. 5, 9. Lower Zemorrian, Rupelian, California.

Triplalepidina, gen. nov., Vaughan and Cole, **297,** p. 167. Fam. Orbitoididae. Genotype: *T. veracruziana* Vaughan and Cole, 1938. Upper Eocene.

——— *veracruziana* Vaughan and Cole, **297,** p. 167, pl. 27, figs. 1–9. Upper Eocene, Mexico.

Triticites irregularis (Schellwien and Staff, 1912) var. *annulifera* Rauser-Cernoussova, **247,** p. 113, pl. 3, fig. 10; pl. 4, fig. 3. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *jigulensis* Rauser-Cernoussova, **247,** p. 120, pl. 5, figs. 1–3. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *noinskyi* Rauser-Cernoussova, **247,** p. 109, pl. 3, figs. 5, 6. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *paraarcticus* Rauser-Cernoussova, **247,** p. 117, pl. 4, figs. 7–9. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *pseudoarcticus* Rauser-Cernoussova, **247,** p. 123, pl. 5, figs. 10, 11; pl. 6, figs. 1, 2. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *schwageriniformis* Rauser-Cernoussova, **247,** p. 107, pl. 3, figs. 1, 3. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *secalicus* (Say, 1823), var. *samarica* Rauser-Cernoussova, **247,** p. 112, pl. 4, figs. 1, 2. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *stuckenbergi* Rauser-Cernoussova, **247,** p. 110, pl. 3, figs. 4, 9. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

——— *volgensis* Rauser-Cernoussova, **247,** p. 121, pl. 5, figs. 4, 5, 7. Permo-Carboniferous, Samara and Trans-Volga regions, Russia.

Trochammina ochracea (Williamson, 1858) var. *heron-earlandica* Rhumbler, **254,** p. 191, text figs. 33–37. Recent, Kerimba Archipelago, and North Sea. [For: *Trochammina ochracea* Heron-Allen and Earland, 1915 (non Williamson, 1858), Trans. Zool. Soc. London, ser. 5, vol. 20, pt. 7, p. 619, pl. 46, fig. 28.]

——— *palea* Cushman and Le Roy, **85,** p. 123, pl. 22, fig. 7. Lower Miocene, California.

——— *squamata* Jones and Parker, 1860, var. *astrifica* Rhumbler, **254,** p. 188, text figs. 29–31. Recent, North Sea.

——— ——— ——— ——— var. *adaperata* Rhumbler, **254,** p. 184, text figs. 21–26, Recent, Heligoland and Ireland.

——— ——— ——— ——— var. *intermedia* Rhumbler, **254,** p. 186, text fig. 27. Recent, Heligoland and Ireland. [For: *Trochammina squamata* Heron-Allen and Earland, 1913 (non Jones and Parker, 1860), Proc. Roy. Irish Acad., vol. 31, pl. 3, figs. 7, 8.] Preoccupied by *Trochammina intermedia* Rzehak, 1887, Verhandl. geol. Reichsanstalt Wien, p. 88.

——— ——— ——— ——— var. *obtusa* Rhumbler, **254,** p. 187, text fig. 28. Recent, Heligoland, Kerguelen, Mauritius and Ireland. [For: *Trochammina squamata* Egger, 1893 (non Jones and Parker, 1860), Abh. k. bayer. Akad. Wiss., München, 2. Klasse, vol. 18, Nr. 2, p. 264, pl. 5, figs. 4–6; and for: *Trochammina squamata* Heron-Allen and Earland, 1913, (non Jones and Parker, 1860), Proc. Roy. Irish Acad., vol. 31, pl. 3, figs. 9, 10.]

——— ——— ——— ——— var. *pluricubiculata* Rhumbler, **254,** p. 182, text figs. 19, 20. Recent, Heligoland.

Uvigerina angelina Kleinpell, **165,** p. 292, pl. 18, fig. 12. Lower Mohnian, Tortonian, California.

——— *ecuadorensis* Cushman and Edwards, **82,** p. 83, pl. 14, fig. 7. Lower Oligocene, Ecuador.

——— *hannai* Kleinpell, **165,** p. 294, not figured. Upper Mohnian, Tortonian, California. [For: *U. californica* Hanna, 1928, (non Cushman, 1926), Bull. Am. Assoc. Petroleum Geologists, vol. 12, pl. 9, fig. 3.]

——— *joaquinensis* Kleinpell, **165,** p. 296, pl. 17, figs. 6, 10, 11. Upper Luisian, Helvetian, California.

——— *mantaensis* Cushman and Edwards, **82,** 84, pl. 14, fig. 8. Oligocene? Ecuador. [For: *U. proboscidea* Galloway and Morrey, 1929 (non Schwager, 1866), Bull. Am. Paleont., vol. 15, p. 39, pl. 6, fig. 5.]

——— *nuttalli* Cushman and Edwards, **82,** p. 82, pl. 14, figs. 3–5. Oligocene, Mexico. [For: *U. canariensis* Nuttall, 1932 (non d'Orbigny, 1839), Jour. Paleont., vol. 6, p. 22, pl. 5, fig. 9.]

——— *pseudoampullacea* Asano, **13,** p. 613, pl. 17, figs. 28, 29. Recent, Japan. [For: *U. ampullacea* Cushman, 1913 (non Brady, 1884), U. S. Nat. Mus. Bull., vol. 71, pt. 3, p. 102, pl. 42, fig. 3.]

——— *rustica* Cushman and Edwards, **82,** p. 83, pl. 14, fig. 6. Oligocene?, Venezuela. [For: *U. hispida* Galloway and Morrey, 1929, (non Schwager, 1866), Bull. Am. Paleont., vol. 15, p. 39, pl. 6, fig. 3; for: *U. hispida* Cushman, 1929 (non Schwager, 1866), Contr. Cushman Lab. Foram. Res., vol. 5, p. 95, pl. 13, fig. 35; and for: *U. auberiana* Nuttall, 1928 (non d'Orbigny, 1826), Quart. Jour. Geol. Soc. London, vol. 84, p. 94, pl. 6, fig. 16.]

——— *stephensoni* Garrett, **117,** p. 315, pl. 40, figs. 5–7. Oligocene, Texas.

——— *substriata* Asano, **13,** p. 614, pl. 17, figs. 21, 22. Plio-Pleistocene, Japan.

——— *yabei* Asano, **13,** p. 613, pl. 17, figs. 1, 2. Pliocene, Japan.

Uvigerinella californica Cushman, 1926, var. *parva* Kleinpell, **165,** p. 289, pl. 9, fig. 14. Saucesian, Aquitanian, California. Preoccupied by *Uvigerinella parva* Cushman and Jarvis, 1929, Contr. Cushman Lab. Foram. Res., vol. 5, p. 12, pl. 3, fig. 7.

Vaginulina bathonica Kuhn, **172,** p. 6, text fig. 16. Jurassic, Bathonian, Germany.

——— *bôsô* Asano, **9,** p. 208, pl. 27, figs. 1–3. Pleistocene, Japan.

——— *miuraensis* Asano, **9,** p. 207, pl. 28, figs. 25, 26. Pliocene, Japan.

——— *owaensis* Asano, **19,** p. 208, pl. 26, figs. 8, 9. Pliocene, Japan.

——— *subplumoides* Parr, **234,** p. 75, pl. 1, fig. 7. Upper Eocene, Western Australia.

——— *taylorana* Cushman, **76,** p. 36, pl. fig. 5, 19. Upper Cretaceous, Texas.

——— *tenuisculpta* Kuhn, **172,** p. 7, text fig. 17. Bathonian (Jurassic), Germany.
——— *tibaensis* Asano, **9,** p. 208, pl. 27, figs. 4, 5. Pleistocene, Japan.
——— ——— ——— var. *striata* Asano, **9,** p. 208, pl. 27, fig. 6. Pliocene, Japan. Preoccupied by *Vaginulina striata* d'Orbigny, 1826, Ann. Sci. Nat., vol. 7, p. 257, no. 3; and by *V. striata* Costa, 1856, Atti Accad. Pontaniana, vol. 7, fasc. 2, p. 182, pl. 16, figs. 16 a, A, B.

Valvulineria araucana (d'Orbigny, 1839) var. *malagaensis* Kleinpell, **165,** p. 308, pl. 22, figs. 10–12. Lower Delmontian, Sarmatian, California.
——— *casitaensis* Cushman and Laiming, 1931, var. *subcasitaensis* Kleinpell, **165,** p. 311, pl. 2, figs. 3, 4, 14. Lower Zemorrian, Rupelian, California.
——— *williami* Kleinpell, **165,** p. 315, pl. 7, fig. 14. Upper Saucesian, Aquitanian, California. [For: *Nonionina boueana* Bagg, 1905, (non d'Orbigny, 1846), U. S. Geol. Survey Bull. 268, p. 53, pl. 11, fig. 1.]
Ventilabrella austinana Cushman, **74,** p. 26, pl. 4, fig. 19. Cretaceous, Texas. [For: *V. eggeri* Cushman, 1929, (non Cushman, 1928), Jour. Paleont., vol. 3, p. 314, pl. 34, fig. 7; and for: *V. eggeri* Loetterle, 1937, (non Cushman, 1928), Nebraska Geol. Survey, ser. 2, Bull. 12, p. 35, pl. 5, fig. 5.]
——— *eggeri* Cushman, 1928, var. *glabrata* Cushman, **74,** p. 26, pl. 4, figs. 15–17. Upper Cretaceous, Texas.
Verneuilina ornata Cushman, **75,** p. 28. *Nomen novum* for: *Verneuilina limbata* Cushman, 1936, (non Terquem, 1882), Spec. Publ. 6, Cushman Lab. Foram. Res., p. 2, pl. 1, fig. 2; and for the same species in Spec. Publ. 7, Cushman Lab. Foram. Res., p. 12, pl. 1, fig. 21; pl. 2, figs. 1–5.
Virgulina seminuda Natland, **218,** p. 145, pl. 5, fig. 12. Recent, west coast of North America, depth 597 m.

LIST OF FORMS WITH NOMENCLATURA APERTA

The following forms have not specifically been determined by their authors. As some of them may later on be found to be new species they are recorded here separately. In former Indexes they have been included with the list of new species.

Ammolagena sp., Barbier, **18,** p. 17, pl. 3, fig. 6. Oligocene, Stampian, Alsace-Lorraine.
Angulogerina sp., Asano, **13,** p. 615, pl. 17, fig. 26. Recent, Japan, depth 154 m.
Anomalina sp., Keijzer, **161,** p. 990, text fig. 20. Middle Eocene, Dalmatia, Yugoslavia.

Bathysiphon sp., Parr. **234,** p. 88, pl. 3, fig. 10. Upper Eocene, Western Australia.
Bolivina sp.?, Cushman and McGlamery, **86,** p. 108, pl. 26, fig. 3. Oligocene, Alabama.
——— sp. Kleinpell, **165,** p. 283, pl. 12, fig. 2. Luisian, Helvetian, California.

Bulimina? sp., Kleinpell. **165,** p. 259, pl. 11, fig. 9. Upper Relizian, Burdigalian, California.

Cassidulina sp., Parr, **234,** p. 81, pl. 2, fig. 7. Upper Eocene, Western Australia.
Chrysalogonium sp., Ten Dam, **278,** p. 994, text fig. 1. Oligocene, Holland.
Cibicidella sp.?, Cushman and McGlamery, **86,** p. 112, pl. 28, fig. 7. Oligocene, Alabama.
Cibicides sp., Keijzer, **161,** p. 990, text fig. 19. Middle Eocene, Dalmatia, Yugoslavia.
———? sp., Kleinpell, **165,** p. 356, pl. 6, figs. 13, 18, 21; pl. 20, figs. 11, 13, 14. Lower Mohnian, Tortonian, California.
Climacammina sp., Huzimoto, **151,** p. 273, pl. 8, fig. 5. Uralian, Japan.
Coskinolina sp., Crespin, **70,** p. 7, pl. 1, fig. 13. Eocene, New Guinea (Mandated Territory).
Cristellaria sp., Lacoste and Rey, **173,** p. 320, pl. 21, fig. 10. Lower Vindobonian, Morocco.

Dentalina sp., Kleinpell, **165,** p. 215, pl. 9, fig. 17. Upper Saucesian, Aquitanian, California.
——— sp.?, Kleinpell, **165,** p. 215, pl. 17, fig. 1. Upper Luisian, Helvetian, California.
Discorbis? sp., Kleinpell, **165,** p. 307, pl. 14, fig. 14. Upper Luisian, Helvetian, California.

Elphidium sp., Howchin and Parr, **148,** p. 309, pl. 18, fig. 8. Miocene, Adelaide, Australia.
Entosolenia sp., Cushman and McGlamery, **86,** p. 109, pl. 26, fig. 12. Oligocene, Alabama.
Eponides sp.?, Cushman and McGlamery, **86,** p. 109, pl. 26, fig. 18. Oligocene, Alabama.
———? sp., Kleinpell, **165,** p. 321, pl. 14, fig. 10. Upper Luisian, Tortonian, California.

Ichthyolaria, n. sp., Fagginger-Auer, **105,** p. 21, pl. 3, fig. 9. Liassic, Germany.

Karreriella? sp., Kleinpell, **165,** p. 193, pl. 3, fig. 1. Lower Zemorrian, Rupelian, California.

Lepidocyclina sp., Deb, **95,** p. 35, pl. 5, fig. 2-a. Oligocene, Alpes-Maritimes, France.

Marginulina, n. sp., Keijzer, **161,** p. 989, text fig. 9. Middle Eocene, Dalmatia, Yugoslavia.
———? sp., Kleinpell, **165,** p. 208, pl. 10, figs. 4, 7. Lower Relizian, Burdigalian, California.
——— sp., Parr, **234,** p. 74, pl. 1, fig. 3. Upper Eocene, Western Australia.

Nodosaria? sp., Kleinpell, **165,** p. 220, pl. 4, fig. 8. Lower Zemorrian, Rupelian, California.
Nonion sp., Kleinpell, **165,** p. 236, pl. 9, fig. 12. Upper Relizian, Burdigalian, California.
———? sp., Kleinpell, **165,** p. 236, pl. 14, fig. 13. Upper Luisian, Helvetian, California.
Nummoloculina sp., Maync, **209,** pl. 3, fig. 1-d; pl. 4, fig. 12. Portlandian, Swiss Alps.

Orthophragmina sp., Deb, **95,** p. 31, pl. 2, fig. 2-a. Priabonian, Alpes-Maritimes, France.

Plectofrondicularia sp. I, Keijzer, **161,** p. 990, text fig. 11. Middle Eocene, Dalmatia.

——— sp. II, Keijzer, **161,** p. 990, text fig. 12. Middle Eocene, Dalmatia.
——— sp. Kleinpell, **165,** p. 242, pl. 4, fig. 12. Lower Zemorrian, Rupelian, California.
———? sp., Kleinpell, **165,** p. 242, pl. 14 fig. 11., Upper Luisian, Helvetian, California.
Pleurostomella sp. I, Keijzer, **161,** p. 990, text fig. 13. Middle Eocene, Dalmatia.
——— sp. II, Keijzer, **161,** p. 990, text fig. 12. Middle Eocene, Dalmatia.
——— sp. III, Keijzer, **161,** p. 990, text fig. 15. Middle Eocene, Dalmatia.
——— sp. IV, Keijzer, **161,** p. 990, text fig. 16. Middle Eocene, Dalmatia.
Pulvinulinella sp., Kleinpell, **165,** p. 330, pl. 20, figs. 3, 4, 7. Upper Mohnian, Tortonian, California.
———? sp., Kleinpell, **165,** p. 330, pl. 12, fig. 6. Luisian, Helvetian, California.

Quinqueloculina, sp. indet., Mohler, **213,** p. 18, pl. 4, fig. 7. Jurassic, Rauracian, Swiss Jura Mountains.

Reophax sp., Kleinpell, **165,** p. 186, pl. 1, fig. 7. Lower Zemorrian, Rupelian, California.
Robertina sp., Parr, **234,** p. 80, pl. 2, fig. 5. Upper Eocene, Western Australia.
Rzehakina sp., Cole, **64,** no description, pl. 4, fig. 6. Upper Cretaceous, Florida.

Saracenaria? sp., Kleinpell, **165,** p. 223, pl. 7, fig. 19. Uàper Saucesian, Aquitanian, California.
Siphogenerina sp., Kleinpell, **165,** p. 305, pl. 9, fig. 18; pl. 11, fig. 3(?). Relizian, Burdigalian, California.
Siphonina sp., Parr, **234,** p. 85, pl. 3, fig. 2. Upper Eocene, Western Australia.
Spiroplectammina sp., Parr, **234,** p. 90, pl. 3, fig. 12. Upper Eocene, Western Australia.
Staffella sp., Ciry, **58,** p. 58, pl. 1, fig. 3. Permian, Turkey.

Triloculina sp.? Cushman and McGlamery, **86,** p. 104, pl. 24, fig. 5. Oligocene, Alabama.

Uvigerina sp., Asano, **13,** p. 614, pl. 17, fig. 16. Recent, Japan.
——— sp., Barbier, **18,** p. 14, pl. 2, fig. 6. Oligocene, France.
——— sp.?, Cushman and Edwards, **82,** p. 84, pl. 14, fig. 10. Middle Oligocene, Germany.
——— sp. (2), Kleinpell, **165,** p. 298, pl. 20, figs. 1, 17. Upper Mohnian, Tortonian, California.
———? sp., Kleinpell, **165,** p. 298, pl. 7, fig. 10. Upper Saucesian, Aquitanian, California.

Vaginulina sp., Parr, **234,** p. 75, pl. 1, fig. 4. Upper Eocene, Western Australia.
Valvulammina sp.?, Cushman and McGlamery, **86,** p. 104, pl. 24, fig. 2. Oligocene, Alabama.
Valvulina sp.?, Cushman and McGlamery, **86,** p. 104, pl. 24, fig. 1. Oligocene, Alabama.
Valvulineria sp., Kleinpell, **165,** p. 314, pl. 16, fig. 6. Lower Mohnian, Tortonian, California.
Vulvulina, n. sp., Keijzer, **161,** p. 987, text figs. 1, 2. Middle Eocene, Dalmatia.

NOMINA NUDA

When studying the publications issued during 1938 the writer noted some names of which he does not know whether they were duly published as valid species or varieties, according to the International Rules of Zoological Nomenclature. They are regarded here as *nomina nuda*, until the complete references will be available.

Bolivina tarchanensis, cited by Gherke, **119,** is not accompanied by the author's name.

Sigmoilina spiroloculinoides, and *Quinqueloculina latiovata* apparently are both manuscript names introduced already in 1934 by Subbotina and Chutzieva.

In the paper by Ruzhencev, **258,** the writer came across the following names:

Triticites umbonoplicatus Rauser and Beljaev.
Pseudofusulina callosa Rauser.
——— *chussovensis* Rauser.
——— *kargalensis* Rauser.
——— *lutuginiformis* Rauser.
——— *paragregaria* Rauser.
——— *plicatissima* Rauser.
——— *sulcata* Kor.
——— *urdalensis* Rauser.
——— ——— ——— var. *abnormis* Rauser.

In the paper of Seki, **268,** the following *nomina nuda* are cited:

Schubertella ibukiensis Seki.
——— *omiensis* Seki.
———? *samegaiensis* Seki.
Schwagerina (Pseudofusulina), n. sp., Seki.

SUPPLEMENTS TO INDEX OF NEW SPECIES OF FORAMINIFERA FOR THE YEARS 1933, 1934, and 1936

The following species should be added to the Indices for the years 1933, 1934, and 1936:

Assilina exponens-mamillata Flandrin, 1933, Bull. Serv. Carte géol. Algérie, (2), Strat, Trav. recents des Collaborateurs, fasc. 2, p. 147, pl. 1, figs. 1–14. Priabonian, Tizi-Renif, Algeria.

Cibicides sorrentae Chapman, Parr, and Collins, 1934, Jour. Linn. Soc. London, Zool., vol. 38, p. 571. A new name for: *Truncatulina mundula* Brady, Parker, and Jones, 1888, var. *carinata* Chapman and Crespin, 1928, Rec. Geol. Surv. Victoria, vol. 5, p. 89, pl. 2, fig. 6.

Epifusulina, gen. nov.?— Chen, 1936?, according to Grabau, 1936, Pal. Sinica, (*B*), vol. 8, p. 21, and footnote p. 21. This new genus is based on the same genotype as *Quasifusulina* Chen, 1934. This information was obtained from Palaeont. Zentralbl., vol. 11, 1938, review no. 43. Grabau's paper is not in the compiler's possession.

Fusulina berryi (Jones), n. sp., in Berry, 1933, The Pan-Amer. Geol., vol. 59, p. 270, pl. 22,

figs. 6, 7, 10, from the Carboniferous of Bolivia, and

Fusulina prolongada, n. sp., Berry, 1933, *ibid.*, p. 271, pl. 22, figs. 1, 5, 11, from Carboniferous of Bolivia. Both names were erected by W. B. Jones and attributed to the genus *Schellwienia*. They have not been described or published by W. B. Jones, but since W. Berry uses the same names, and only attributes them to *Fusulina*, the correct author is W. B. Jones.

MANUSCRIPT RECEIVED BY THE EDITOR APRIL 14, 1941.

JOURNAL OF PALEONTOLOGY, VOL. 15, NO. 6, PP. 691–692, NOVEMBER, 1941

PALEONTOLOGICAL NOTES

USE OF SOAP IN THE PREPARATION OF SAMPLES FOR MICRO-PALEONTOLOGIC STUDY

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One of the major problems which confronts micropaleontologists working with sandy formations such as the Wilcox Eocene, or the Miocene of the Gulf Coast salt dome region, is the separation of the sparse microfauna from the abundant sand grains. The use of carbon tetrachloride has proven successful in many cases where the tests of Foraminifera are hollow and well preserved, but is ineffective for heavy tests and for ostracodes. The use of bromoform is both tedious and expensive where large quantities of material are involved.

Several years ago I discovered that, if soap or washing powders were added to the sample while it was being washed, not only was the separation of the mud greatly speeded up, but by using *warm water* and adding more soap, a point was reached where practically all shell material, Foraminifera, ostracodes, small mollusks and so forth floated and could be readily decanted off. By washing the samples on a 200-mesh sieve, no difficulty will be encountered in decanting the material that floats onto another 200-mesh sieve. If coarser sieves are used, the sample will probably have to be transferred to a pan, such as miners use, for the decanting operation, as the water will pass too freely through coarser sieves to permit decanting directly.

The proper amount of soap to use may be readily determined with a little practice. Once the shell material has started to float, the washing may continue until all vestiges of suds have disappeared. An oblique current of water across the sieve will pick up the shells even though no suds are visible. With most sands, a nearly complete separation may be made in a few minutes by this method. It is not so easy in case of limestones, however, as the lime particles tend to come up with the shells. For sandy marls containing many broken fragments of mollusks, it will probably be necessary to use bromoform to make a further separation after the decanting has taken place. It is the only satisfactory method which I have found to separate single valves of ostracodes from sparsely fossiliferous sands.

CYTHERIDEA (CLITHROCYTHERIDEA) WILCOXENSIS STEPHENSON, NEW NAME[1]

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In describing a number of species of the ostracode genus *Cytheridea* from the lower Eocene of Alabama (Stephenson, 1938), I referred certain of my specimens to *Cytheridea* (*Clithrocytheridea*) *pendletonensis* Howe and Garrett (1934). Mr. J. B. Garrett has kindly called my attention to an error in identification of this material, and has loaned me topotypes of *C.* (*C.*) *pendletonensis* from his collections. My Alabama specimens are smaller and more heavily sculptured, with rugged ridges and pits covering nearly the entire carapace wall. My material is likewise distinct from *C.* (*C.*) *pyeatti* Howe and Garrett, especially in its smaller size and the two longitudinal ridges.

It appears that the form from the Wilcox

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of Alabama which I assigned to *C.* (*C.*) *pendletonensis* is a new species. I herewith propose the new name *Cytheridea* (*Clithrocytheridea*) *wilcoxensis* Stephenson for this species. The type specimens, holotype, no. 1469, and paratypes, nos. 1470 and 1471, are deposited in the H. V. Howe collection, Louisiana State University, University, La.

REFERENCES

HOWE, H. V., and GARRETT, J. B., *1934*, Louisiana Sabine Eocene Ostracoda: *Louisiana Dept. Cons., Geol. Bull.* 4, pp. 36, 37, pl. 2, figs. 7–10.

STEPHENSON, M. B., *1938*, Lower Eocene Ostracoda of the genus *Cytheridea* from Alabama: *Jour. Paleontology*, vol. 12, pp. 578, 579, pl. 67, fig. 18, text figs. 37, 38.

JOURNAL OF PALEONTOLOGY, VOL. 15, NO. 6, PP. 693–699, NOVEMBER, 1941

REVIEWS

Ulemosaurus svijagensis RAIB.—EIN DINOCEPHALE AUS DEN ABLAGERUNGEN DES PERM DER UDSSR, by J. A. Efremov. Nova Acta Leopoldina, Deutsche Akad. d. Naturf., Halle, Neue Folge, Bd. 9, no. 59, 1940, pp. 155–205, 17 text figs. (5 RM).

Fossil reptiles form one of the most striking and significant elements of the Permian faunas—one that largely influenced Murchison to propose the Permian as a distinct system. Nevertheless, for over three-quarters of a century few reptiles were known from the type region of the Permian, South Africa and southwestern United States supplied the bulk of our knowledge of these animals. During recent years, however, there has been a great renaissance in paleontological studies in the U. S. S. R. under the leadership of the Soviet geologists, and deposits of Permian reptiles have been discovered and exploited that in many respects will rival the well-known occurrences of South Africa. Members of the 17th International Geological Congress were amazed at the wealth and fine preservation of the material recently mounted in the new Museum of the Academy of Sciences in Moscow.

This rich material has only been described in part and is still being actively studied. Preliminary reports on some of the finds now must be followed by revisions and more critical studies such as the present one by Dr. Efremov. It is a very comprehensive and detailed morphological study of one genus of the large plant-feeding saurians discovered about 10 years ago in the typical Permian beds in the Volga valley. The description is followed by a critical comparison with related genera, both of the U. S. S. R. and of South Africa.

CARL O. DUNBAR

PRELIMINARY REPORT ON THE CRETACEOUS AND TERTIARY LARGER FORAMINIFERA OF TRINIDAD, BRITISH WEST INDIES, by Thomas Wayland Vaughan and W. Storrs Cole. Geological Society of America, Special Papers No. 30, pp. i–viii, 1–137, plates 1–46, 2 figures in the text, February 25, 1941.

This account should prove indispensable to all students of American species of larger Foraminifera since it includes a great deal more than the modest title would lead one to expect. It commences with a concise summary of the Eocene and Oligocene stratigraphy of Trinidad, followed by a somewhat more detailed account of the geology of Soldado Rock, illustrated by a geologic map and a series of cross sections. These brief accounts are condensed fron two recent papers by Dr. H. G. Kugler (1936, 1938), who is also responsible for the map and sections. For bibliography the reader is referred to E. Lehner, 1935, "Introduction a la géologie de Trinidad et bibliographie géologique" (Office national des Combustibles liquides Ann. No. 4, pp. 691–730). Since this may not be readily accessible to to many workers it may be worth noting that most of the titles listed by Lehner (156 in number) may be found in the series of 'Bibliographies of North American Geology' published by the United states Geological Survey (Bulletin Nos. 823, 834, 858, 869 and 892). For students requiring a more detailed list of references (332 titles) the "Bibliography of West Indian Geology" by Prof. L. M. R. Rutten (Geographische en Geologische Mededeelingen, Physiographisch Reeks No. 16, Utretcht 1938, pp. i–vii, 1–103) may be consulted.

The stratigraphical introduction is followed by a detailed list of samples and sample localities accompanied by a map of Trinidad showing their locations. The distribution of the faunas is then discussed relative to the geologic section. Under the heading 'Lower Eocene' (pp. 24–26) is a discussion of the use of the term 'Paleocene' as employed in Europe by Schimper and as adopted by the Committee on Geologic Names of the United States Geological Survey, pointing out that the restriction of the term to the Midway group in America introduces a discrepancy between America and European usage, the latter including higher beds, which, in America, are included in the lower Eocene.

The richest faunas of larger Foraminifera are listed from the Upper Eocene Mount Moriah beds and from the Oligocene (beds equivalent to the Mesón, Antigua and Flint River formations). Small faunas are recorded from the Lower Eocene and from the Miocene but no larger Foraminifera were found in samples of Middle Eocene age. Under the heading 'Ecology' reference is made to an earlier study by Vaughan (1933), the final conclusion reached being that the orbitoidal beds of Trinidad were probably deposited in shallow, warm seas (depth about 50 metres, at a temperature of 25–30°C.).

Sixty-six species and varieties of Foraminifera are described and figured in the systematic portion of the work (pages 31–80), the illustrations consisting of an excellent series of photographs of exteriors and thin-sections (plates iv–xlvi). *Miscellanea* Pfender 1934 is discussed in some detail, its identity with *Pellatispirella* Hanzawa 1937 is put forward and the early confusion of Asiatic species with *Siderolites* Lamarck 1801 is noted. The genotype and previously described species are refigured, and two, *M. soldadensis* and *M. tobleri* are described as new. The genus *Operculinoides* is treated at some length (pp. 36–54, pls. viii–xv) and several American species hitherto imperfectly known are redescribed and adequately figured. Four species and one variety are described as new. The occurrence of *Spiroclypeus* in the New World Oligocene is established beyond question and a new species, *S. bullbrooki*, is described and figured, mention being made of its occurrence in Martinique associated with *Lepidocyclina giraudi*.

The family Discocyclinidae (Vaughan and Cole 1940) is discussed, the internal structure and affinities with other groups are considered and the authors' earlier account (in Cushman, "The Foraminifera, Their Classification and Economic Use," 3rd Ed., 1940) is amplified and slightly emended by the addition of the subgenus, *Pseudophragmina* H. Douvillé s.s. It is unfortunate that the name *Discocyclina papyracea* (Boubée), as used by Gümbel, Hantken, M. G. Rutten and others, should be repeated here, rather than the correct name of *D. pratti* (Michelin). Schlumberger in 1902 pointed out that *Nummulites papyracea* Boubée 1832 was identical with *Orbitolites gensacica* Leymerie 1851 from the Cretaceous (Soc. géol. France Bull, 4e. sér., tome II, pp. 255–256), and in 1903 (loc. cit., tome III, p. 274) stated that the *O. papyracea* of Gümbel and d'Archiac from the Eocene of Kressenberg was synonymous with *Discocyclina pratti* (Michelin), the genotype of *Discocyclina*. Galloway has summarized this in his "Manual of the Foraminifera," and pointed out that *N. papyracea* Boubée becomes the genotype of *Simplorbites* de Gregorio, standing as *Simplorbites papyracea* (Boubée). Three new species of *Discocyclina* are described from the Trinidad collections (*D. barkeri*, *D. bullbrooki* and *D. grimsdalei*) and the surprising variability of *Asterocyclina asterisca* (Guppy), which has caused so much confusion in the past, is admirably shown by the photographs on plate xxiii. Two new species of *Pseudophragmina*, *P.* (*Proporocyclina*) *tobleri* and *P.* (*Athecocyclina*) *soldadensis*, are described from the upper Eocene of Soldado Rock.

In the treatment of the Orbitoididae the emendation and re-definition of *Pliolepidina* Douvillé 1915, with the subsequent clarification of what should be included under *Lepidocyclina trinitatis—pustulosa* is an outstanding advance in our knowledge of the group. *L. trinitatis* Douvillé 1923 is shown to be a synonym of *L. pustulosa* Douvillé 1917 by most convincing evidence, supported by an excellent suite of figures (pls. xxv–xxx), and since *Pliolepidina tobleri* is shown to be a teratologic development of *L. pustulosa*, the latter now becomes the subgenotype of *Pliolepidina*. This necessitates an emendation of the subgenus, which was originally based on the form of the embryonic apparatus, and this is achieved by a study of the stolon-system and the general form of the equatorial chambers. The general study of the genus *Lepidocyclina* is enhanced by a thorough examination of the stolon-systems of a number of species, illustrated by exceptionally fine photographs of sections decalcified after balsam impregnation. Only one new species, *L.* (*Nephrolepidina*) *sanfernandensis*, was found in the collections examined.

The family of Miogypsinidae, with description of two species, neither of them new, is well treated. Workers on this group will

appreciate the list of species recorded from America, and the brief reference to a recent paper by S. Hanzawa in which he proposes two new genera, *Miogypsinella* and *Miogypsinopsis*, for certain American species. *Planorbulinella trinitatensis* (Nuttall) is mentioned, though not figured or described, but no reference is made to Silvestri's figure of this species in 1920 as *Planorbulina larvata* (Soc. geol. italiana Boll., Vol. XXXIX, fasc. 1–2, pp. 70–77, text fig. 2). In an appendix (pp. 86–87) a new species of *Helicostegina* (*H. soldadensis*) is described and figured by Thomas F. Grimsdale and a note is given on the relation of the new species to those previously described and to *Helicolepidina*.

Although the bibliography makes no pretensions to completeness it is so nearly so with regard to the larger Foraminifera of Trinidad and the Caribbean region in general that certain omissions are surprising. Among those especially noted are the following:

SENN, ALFRED, 1935, Die stratigraphische Verbreitung der tertiären Orbitoiden, mit spezieller Berücksichtigung ihres Vorkommens in Nord-Venezuela und Nord-Marokko, *Eclog. geol. Helvet.*, Vol. XXVIII, No. 1, pp. 51–113, pls. viii–ix (Nachtrag, loc. cit., pp. 369–373.)

THALMANN, HANS E., 1932, Das Vorkommen der Gattung *Miogypsina* Sacco 1893 in Ost-Mexiko: *Eclog. geol. Helvet.*, vol. 25, No. 2, pp. 282–286.

——, 1934, "Mitteloligozän in der Umgebung von Tampico (Mexiko)." *Geol. Rundschau.* vol. 25, pp. 325–329.

——, 1934, *Lepidocyclina canellei* Lemoine & R. Douvillé im Oligozän von Tabasco (Mexiko): *Centralbl. Mineralogie*, Jahrg. 1934, Abt. B., no. 10, pp. 446–448.

TOBLER, A., 1922, Die Jacksonstufe (Priabonien) in Venezuela und Trinidad: *Eclog. geol. Helvet.*, vol. 17, no. 3, pp. 342–346, pl. xix.

——, 1922, Ein neuer Orbitoid aus dem älteren Tertiär von Venezuela und Trinidad: *Verh. Schweizen natfur Gesell*, Bern, vol. 103, Vers., pp. 230–231.

——, 1926, Miogypsina im untersten Neogen von Trinidad und Borneo: *Eclog. geol. Helvet.*, vol. 19, pp. 719–722.

R. WRIGHT BARKER

A SYNOPSIS OF THE ORBITOIDIDAE, by Dr. M. G. Rutten. Geologie en Mijnbouw (Tijdschrift van het Geologisch-Mijnbouwkundig Genootschap voor Nederland en Kolonien), 3e. Jaargang, Nieuwe Serie, No. 2, pp. 34–62, February 1941.

This excellent account of the various genera and subgenera of the Orbitoididae gives clear concise definitions with clear explanatory diagrams which should prove equally valuable to both the academic and the economic worker on the Foraminifera. Fourteen genera and ten subgenera are distributed in three subfamilies: Pseudorbitoidinae, Orbitoidinae and Lepidocyclininae, based upon internal characters, largely those of the equatorial layer. The erection of a new subfamily for the genus *Pseudorbitoides* seems hardly justified, although Rutten points out that this is due to insufficient knowledge of the genus, which may be removed eventually from the Orbitoididae.

The generic descriptions are based throughout on careful study of internal structure incorporating the results of extensive researches on the stolon-systems and nuclear development of the test by T. Wayland Vaughan, Tan Sin Hok, Rutten himself and others. There is little comment required on the generic descriptions, which are largely amplifications of the original accounts, but one or two points seem worthy of note. Thus *Actinosiphon*, as will be discussed shortly, should probably be regarded as a lower Eocene genus; *Pliolepidina* is correctly noted as possessing a four-stolon system, but the suggestion of Douvillé (1924) that the embryonic apparatus is probably a teratologic feature, and that the subgenotype (*P. tobleri* ~~Douvillé~~) is probably a form of *Lepidocyclina trinitatis* Douvillé (now *L.* (*Pliolepidina*) *pustulosa* Douvillé) was not given the attention it merited, and it has remained for Vaughan and Cole to study and emend the subgenus (Geol. Soc. America, Special Papers No. 30, pp. 64–67, pls. xxiv–xxx, February 1941).

Since the most striking feature of the paper is the phylogenetic approach, admirably summarized in the tables on pages 46–47, any criticism to be made should apply, perhaps, to this aspect. The point which seems most open to criticism is the derivation of *Actinosiphon* from *Pseudolepidina* at the close of the middle Eocene. *Pseudolepidina* makes its first appearance early in the Middle Eocene of Mexico and may perhaps be derived from *Helicostegina* or, with that genus, from a common amphisteginoid ancestor. *Actinosiphon semmesi*,

genotype of *Actinosiphon*, was described from the lower Eocene (possibly Paleocene) Chicontepec of Mexico, antedating *Pseudolepidina*. *Lepidocyclina vichayalensis* Rutten, regarded as probably *Helicolepidina* by T. Wayland Vaughan and by the writer (JOUR. PALEONTOLOGY, vol. 8, 1934, pp. 350–351), occurring in the Upper(?) Eocene of Peru, was placed in *Actinosiphon* by Rutten in 1935 (JOUR. PALEONTOLOGY, vol. 9, pp. 546–547) largely on the evidence of radial stolons. Since Vaughan has shown that *Helicolepidina nortoni* also possesses radially situated stolons, and since the general form and arrangement of the equatorial chambers in *L. vichayalensis* show greater similarity to *Helicolepidina* than to *Actinosiphon*, it seems preferable to restrict *Actinosiphon* to the genotype, and to regard it as a genus of doubtful affinities, confined to the early Eocene of Mexico. In no case is it possible to derive it from *Pseudolepidina*, and it seems doubtful if any close connection exists between the two genera.

Other minor points concern the position of *Lepidocyclina* and *Pliolepidina* in the chart. The former has been reported quite recently from the Claiborne of Mississippi by Gravell and Hanna (JOUR. PALEONTOLOGY, vol. 14, 1940, pp. 412–416). This early species (*L. claibornensis*) is distinctly primitive in type, showing affinities with *Polylepidina* and with *Eulinderina semiradiata* Barker and Grimsdale, though possessing well developed lateral chambers. Without querying the polyphyletic origin of *Lepidocyclina*, or its derivation in part from *Polylepidina*, it now becomes necessary to place its origin somewhere in middle Eocene time rather than in the upper Eocene. *Polylepidina* is also placed somewhat high in the section since it makes its appearance rather early in the middle Eocene and reaches its maximum development in the Caribbean region before the close of that period.

A short note on the amphisteginoid ancestor of *Helicostegina* may not be out of place. Both Rutten (p. 52) and Tan Sin Hok have pointed out that *Amphistegina lopeztrigoi* Palmer is an Upper Eocene species, that *Helicostegina* appears near the lower Eocene-middle Eocene boundary and that *A. lopeztrigoi* therefore cannot be the ancestor of the earlier *Helicostegina*. This is reasonable, but they ignore a statement that the ancestral forms, compared with *A. lopeztrigoi*, were found in Mexico in the Middle Eocene, possibly lower Middle Eocene (see Barker & Grimsdale, JOUR. PALEONTOLOGY, vol. 10, 1936, p. 233). The Mexican specimens were carefully compared with topotypes from the Upper Eocene of Cuba, kindly supplied by Mrs. D. K. Palmer, and found to differ essentially only in size. It was therefore assumed that the species was long-ranging and might well have appeared earlier than the rare occurrences noted in Mexico, and thus could be regarded as the ancestor of *Helicostegina*.

The account is accompanied by numerous excellent figures which form a valuable adjunct to the generic descriptions, though it is a pity that all the genotypes are not illustrated since such figures are essential when studying a genus, and are of the greatest value in giving a general view of a family, especially when the various genera are treated phylogenetically. No bibliography is given, but in view of the many lists available in recent publications this is of little import. The account is thorough and the result of much painstaking work, and is to be recommended as an exceptionally fine study of the Orbitoididae. It is to be hoped that other groups will receive such detailed attention in the future, since the phylogenetic approach, wherever possible, is undoubtedly the ideal method of obtaining a rational classification.

R. WRIGHT BARKER

PHACOPID TRILOBITES OF NORTH AMERICA, by David M. Delo, Geological Society of America, Special Paper No. 29, 1940.

Paleontology as well as the fossils with which this science deals shows unmistakable evidence of evolution. The days of the species-maker when almost any good specimen (and many not so good) became the basis for a new name, are gone but can never be forgotten. The systematic description of faunas from a single or a few related localities or horizons was a great advance but the comparison of specimens with more or less satisfactory published figures and more or less adequate published descriptions, which such studies involved, and the identifications that resulted therefrom left much to be de-

sired. The significance of apparent minor differences, if recognized, was uncertain and many highly questionable species and varieties were proposed. On the other hand, other entirely valid differences went unnoticed and the common conception of many species today is based upon well illustrated and described but misidentified specimens.

In the same way that the old fashioned college course in "guide fossils" is rather futile (because a student cannot identify a guide fossil unless he can differentiate it from all of its near relatives) so also the faunal approach to paleontology is unsatisfactory so far as the recognition of species is concerned. This fact is becoming increasingly evident at the present time because of the growing tendency, with which I am in complete sympathy, toward the more precise discrimination of species. More and more old "species," such as the Pennsylvanian *Spirifer cameratus* and *Chonetes mesolobus*, are being raised to the rank of genera and subdivided in spite of the protests and to the consternation of many geologists to whom the old concepts are familiar. Such "splitting" if based upon adequate studies, is, however, mostly justifiable and advantageous. In place of a comparatively few elastic and long ranging species possessing only the broadest stratigraphic significance, we are thereby provided with a greater number of species of much restricted stratigraphic range. It is true that the resulting species are much more difficult to recognize and separate and the time is rapidly approaching when the identification of species must become the task of specialists while others content themselves with generic differentiations only.

The only sound method by which finely discriminated species can be recognized is the study of fossils on a zoologic rather than a faunistic basis and the initiation of such studies marks the beginning of the third and modern stage in the evolution of paleontologic science. It is not my intention to condemn the continued study of faunas, for much new information of great significance can be contributed by such investigations. I do, however, wish to emphasize my belief that zoologic studies promise to produce truly fundamental data whose importance to the systematic paleontologist, stratigrapher and historical geologist can scarcely be overestimated. All previous paleontologic and stratigraphic work forms the background for such zoologic studies, and increasingly abundant collections and well identified fossiliferous zones furnish a more and more adequate basis for them.

Zoologic studies, however, are much more difficult than the identification and description of a fauna, which may be successfully undertaken by any good student who has access to a large library, because they require the coöperation of many individuals and institutions in the loan of specimens, unusually keen observation without which minute differences may be overlooked, thorough knowledge of the facts of stratigraphy and paleogeography so far as they are known, the power of analysis to determine which differences may be significant and which may not, and a sound philosophy of specific differentiation. A zoologic study should be restricted to a family or some well marked subdivision of a family that lived during one or more geologic periods. It requires a large number of specimens adequately distributed stratigraphically and geographically in order that the ranges of forms in both time and space may be tested and their relations determined. All existing types must be studied in order that nomenclature may be stabilized and because some features of these specimens whose significance were unrecognized have generally escaped description and illustration. All this appears to be a large order and so it is. A complete and successful zoologic study is, in fact, of more than monographic scope as that word is commonly understood.

A question that inevitably arises in any paleontologic study is: What is a species? The concept of species originated with observers of living organisms and in spite of certain difficulties, such as that introduced by regional or environmental variation, most living species are distinct entities and the creatures that lived contemporaneously during any brief period in the past may generally likewise be grouped satisfactorily into species. The paleontologist's problem, however, is complicated by the element of time, and if our record of past life were complete we would find that each momentarily distinct species passes imperceptibly into

other species that were equally distinct in earlier and later times. Let us admit at once, therefore, that the species is an artificial concept that originated in ignorance and has survived because it is the basis of a system of classification that we still find useful. Like the units in other more or less artificial classifications of natural objects the species can be defined only as a group which for the sake of convenience is considered as a unit. Different persons are inclined to disagree concerning groups that form convenient units, and ideas change with the passage of time and the accumulation of information. Thus it is only natural that smaller and smaller groups should be recognized as units or species. This is progress, providing the new units are based upon the careful study of adequate suites of specimens. My personal inclination is to accept as a full species any group which possesses common characters, recognizable in fairly well preserved specimens, that are of definite stratigraphic or geographic significance.

Fortunately the paleontologist is not plagued by the multinomial nomenclature that characterizes some branches of modern zoology. Trinomials are, I believe, as far as we have gone in that direction. In general, however, I am not in sympathy with the recognition of varieties in paleontology. The proposal of a variety implies two things: First, it is an admission by the author of doubt regarding the validity or significance of the differences noted. If such doubt exists I feel that no new name should be introduced. Second, it definitely suggests that the variety is very closely related to the "parent" species. There may be good presumptive evidence that this is so but mostly such a conclusion can be no better than a guess and I believe that conservatism demands the heavy discounting of any such conclusion. The recognition of varieties has resulted in at least one curious situation in which a variety antedated and was probably the direct ancestor of the "parent" species.

This is a rather lengthy introduction to a discussion of Delo's work on the Phacopid trilobites, but I wish in some measure to explain why I welcome such a work with more than ordinary enthusiasm and some of my remarks have led on to other matters not particularly pertinent to this review. Delo's work is a zoologic study of the type which I believe is pointed in the right direction and it will certainly be of great usefulness to all future students of the American Dalmanitidae and Phacopidae. Unfortunately, however, the pressure of academic duties in a small college and the lack of adequate library and collections has prevented the author from carrying this work to a full conclusion.

Following the classification previously proposed by him, Delo recognizes the superfamily Phacopidacea as composed of the Phacopidae and Dalmanitidae. This is the same group classed as the subfamily Dalmanitinae by Reed and as the family Phacopidae by Richter and Richter. By raising the rank of the group to superfamily Delo has avoided the confusion that attends the recognition of subgenera. Perhaps it would have been better to have followed Reed's rather than the Richters' lead and named the super-family Dalmanitacea for the dalmanitid trilobites are not only longer ranging and more numerous, in this country at least, but also in some respects apparently are more primitive, and it is somewhat surprising to find more than three-quarters of a work entitled Phacopid Trilobites devoted to dalmanitid species.

In his general classification Delo recognizes four subfamilies in the Phacopidae, a like number in the Dalmanitidae and a total of 60 genera. All but two of the subfamilies of Phacopidae are recognized in America, represented by 24 genera, two of which are new. These are all diagnosed, but the main part of the publication is devoted to descriptions and discussions of 139 American species and 10 varieties. Of these species 27 are new (12 new species as well as one new genus are credited to Ulrich and Delo) and six are considered to be unrecognizable. Three of the varieties are new. Delo attempted to locate and study all of the original types but twenty-four could not be found. Since the report was completed about half of these have turned up in the American Museum of Natural History and the others are presumably lost. At the time the manuscript was submitted for publication it did not quite completely cover the American phacopid and dalmanitid trilobites. Perhaps the most important omission was *Asteropyge*

fitzpatricki Walter but there were likewise a few other species which have received no notice since their original publication and whose types are lost. These names should have been listed although the latter group cannot be recognized and should not be resurrected from oblivion.

One of Delo's most important conclusions is that specimens from other areas that have been commonly referred to some of the supposedly well known New York species are specifically distinct and several of the new species proposed in this, as well as in his previous papers, are based upon such specimens. The descriptions are brief but apparently adequate and individual discussions are pertinent. A few terms are used which are probably unfamiliar to most American readers but although they are not defined their meaning can generally be made out from the context. The "subcranial furrow" should, however, somewhere be described.

In his introductory pages Delo includes a section on "principles of classification" which discusses the various characters that are considered to be important. Cephalic structure, particularly glabellar lobation, is of course of paramount significance in the recognition of families and subfamilies. Some subfamilies and many genera, however, are separated on the basis of other features such as general body form, proportion of parts, pygidial annulation, and ornamentation. Another section on "evolutionary development" is rather inconclusive. Delo believes that the Phacopidacea are classified on an evolutionary basis but his apparent failure to work out the genetic relationships of its various subgroups casts some doubt upon this conclusion. Some of the features relied upon for classification are known to have developed independently and at different times in separate branches of other trilobite families, and one may suspect that the same has likewise occurred here and that some parts in the scheme of classification are misdirected. A chart indicating geologic ranges of the genera would be not only significant in this connection but of considerable general interest. Also a chart showing the author's interpretation of the genetic interrelationships existing within this superfamily would be useful even though it were admittedly highly speculative.

Delo's synonymies are extremely brief and far from complete and he states that only the more important and trustworthy references are included because it was not possible for him to study specimens from many horizons and localities. A complete bibliography of these trilobites would be most useful, however, and it is to be regretted that other references were not added to the synonymies with a requisite sprinkling of question marks or included in an appendix.

Many of the species discussed in this report were based on cotypes, and no types were previously designated from rather extensive suites of specimens for some of the older species. Delo has selected cotypes for several species in this latter group, but I believe that he should have taken advantage of this excellent opportunity to designate letcotypes for a great majority of the species and thus place them upon an entirely unequivocal foundation.

It is of course much easier to criticize a piece of work adversely than to convincingly praise its good features. The points that I have just raised cannot detract in any way from the very real merit of Delo's work or the importance of his report. I mention them chiefly in the hope that future studies of this type may be more complete and therefore more useful to all paleontologists. There is, however, one serious and disappointing deficiency that must be mentioned: inadequate illustration. Only 13 somewhat poorly arranged plates are presented for 139 species and 10 varieties, and nearly half of these forms are illustrated by a single figure. Moreover many of the figures are too small, being reductions below natural size although enlargements of all but the larger specimens would be desirable. Finally too many figures are copied from previous publications, and numerous original photographs are indistinct because of poor lighting and failure to properly whiten the specimens.

J. MARVIN WELLER

ERRATA

JOHNSTON, F. N. "Trias at New Pass, Nevada (New Lower Karnic ammonoids)" Jour. Paleontology, vol. 15, no. 5, pp. 447–491, pls. 58–71, text figures 1–3.

p. 447 Abstract, line 5: for "*Trachyceras anonoides*" read *Trachyceras aonoides.*

p. 451 Explanation of Plate 59, line 2: for "*4*, D = 21.2 mm." read "*4*, D = 21.6 mm."; for "*5*, D = 21.6 mm." read "*5*, D = 24.1 mm."; and for "*6*, D = 24.1 mm." read "*6*, D = 21.2 mm."

p. 452 Left column, line 9: for "fig. 5 (7)" read "fig. 4 (7)," and for "fig. 6 (8)" read "fig. 5 (8)," and for "fig. 4 (6)" read "fig. 6 (6)."

Explanation of Text Figure 1, D: for "*Hannaoceras newpassensis*" read "*Hannaoceras newpassense.*" Under "C," for "fig. 5" read "fig. 4."

p. 455 Right column, under "(1–3) *L. trauthi*, n. sp. . . . ": for "pl. 59, figs. 18, 19 (2) (type, shows sutures)" read "pl. 59, figs. 18, 19 (3) (shows aperture)," and for " . . . fig. 20 (3) (shows sutures)" read "fig. 20 (2) (type, shows sutures)."

p. 459 Explanation of Plate 61: for " . . . g, D = 21.1 mm." read " . . . 6, D = 21.1 mm."

p. 466 Explanation of Plate 63, last line but one: omit "type"; and for "U. S. Nat. Mus. 77524" substitute "U. S. Nat. Mus. 77527."

p. 476 Explanation of Plate 66, under "*Procladiscites mulleri* Johnston, n. sp.": for "*5*, *7*, Enlargements, ×3, of the same specimen as shown in *6*, . . . " read "*5* is an enlargement, ×3, of a specimen of 29.2 mm. D. *7* is an enlargement, ×2, of the same specimen as shown in *6*, D = 43 mm."

Plate 66, fig. 7 is "×2" instead of "×3."

p. 480 Left hand column: add "Pl. 66, fig. 5 (4)." to the explanation of the table.

p. 483 Left hand column: in the heading under *Trachyceras* (*Trachyceras*) *desatoyense*, for " . . . pl. 68, figs. 4–7" read " . . . pl. 68, figs. 4–5."

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